DSS FILE NO: 14SQ.23440-7-9006
SERIAL NO.: 23440-7-9006/01-SQ

the cambrian engineering group limited

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TITLE PAGE

TITLE: CONSTRUCT AND INSTALL A PILOT PLANT ELECTRONIC INSTRUMENTATION SYSTEM

FINAL REPORT

BY

THE CAMBRIAN ENGINEERING GROUP LIMITED

Work on the project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada.

DSS FILE NO: 14SQ.23440-7-9006

DSS CONTRACT SERIAL NO.: 23440-7-9006/01-SQ

CANMET PROJECT NO.: 504102-01

CANMET SCIENTIFIC AUTHORITY: DR. J.D. CHASE

DATE: MAY, 1988

92 pp

MICROMEDIA

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- Drawing Lists
- New Coprocessing Pilot Plant Paper for
  Presentation at The Third Chemical
  Congress of North America, Toronto,
  June 1988

EXECUTIVE SUMMARY

The contract initiated on August 10, 1987, was substantially completed on April 22, 1988 with final documentation and deliverables transmitted in May, 1988. The prime contractor was The Cambrian Engineering Group Limited with two major subcontracts to Kennedy Electric Limited for field wiring and installations, and to Custom Control Panels Limited for panel fabrication.

The work of the contract was completed and technically accepted as good by the Scientific Authority and other EMR representatives. The contractor and his subcontractors were similarly satisfied that a first rate installation was achieved.

EMR retain a responsibility for compliance with Ontario Hydro codes and requirements both for instrumentation purchased without CSA labelling and for existing non-conforming electrical installations in the vicinity of Pilot Plant 3.

Two minor contract price amendments were authorized increasing the original contract amount by 4.85%. Given the scope and complexity of the contract work, the magnitude of the price changes was moderate.

The work of the contract was substantially completed by the fiscal 1987-88 year end. Completion of verification testing, correction of deficiencies and provision of final documentation were finished in April and May of 1988.

The technical deviations from documentation provided at the outset of the contract were resolved without difficulty, with the exception of the contract time.

A question regarding the level of on-site supervision by the contractor was raised by the Scientific Authority. A fuller discussion with recommendations for future handling of this topic are found in the conclusions section of this report.

SOMMAIRE EXÉCUTIF

Le contrat entrepris le 10 août 1987 a été substantiellement achevé le 22 avril 1988; la transmission des derniers documents et autres articles livrables a été effectuée en mai 1988. L'entrepreneur principal était le Cambrian Engineering Group Limited, qui a confié deux importants sous-contrats à Kennedy Electric Limited pour les travaux d'installation et de câblage sur place, et à Custom Control Panels Limited pour la fabrication des tableaux de commande.

Le travail prévu par le contrat a été complété; il a fait l'objet d'une réception technique avec mention "bonne" de la part de l'autorité scientifique et des autres représentants de EMR. L'entrepreneur et ses sous-traitants considéraient également qu'une installation de première classe avait été réalisée.

EMR demeure responsable de la conformité à l'égard des codes de Ontario Hydro et d'autres spécifications en ce qui concerne les instruments achetés sans homologation de l'ACNOR, et pour les installations électriques non conformes existantes au voisinage de l'usine pilote numéro 3.

Deux amendements mineurs au prix contractuel ont été autorisés, ce qui a fait monter le coût original du contrat de 4,85%. Compte tenu de l'ampleur et de la complexité des travaux couverts par le contrat, on considère que cet ajustement du prix est modéré.

Les travaux prévus par le contrat ont été substantiellement achevés avant la fin de l'année fiscale 1987-88. Les essais de vérification, et les corrections des déficiences et la fourniture de la documentation finale ont été achevés en avril et mai 1988.

Les écarts techniques par rapport aux documents fournis à l'origine du contrat ont été résolus sans difficulté, à l'exception de la durée d'exécution du contrat.

L'autorité scientifique a soulevé une question concernant le niveau de supervision sur place par l'entrepreneur. On trouve à la section des conclusions de ce rapport une discussion complète avec recommendations à l'égard du traitement de ce sujet à l'avenir.

INTRODUCTION

The contract to Construct and Install a Pilot Plant Electronic Instrumentation System was awarded to The Cambrian Engineering Group Limited on August 10, 1987 based on a fixed price submission in response to DSS RFP File No. 14SQ.23440-7-9006 dated May 19, 1987. Field installation and wiring was subcontracted to Kennedy Electric Limited who were named in the proposal submission. Panel fabrication was subsequently subcontracted out to Custom Control Panels Limited. Addresses and contact individuals for the contractor and subcontractors are appended to this section.

On-site work at the CANMET Bells Corners facility commenced in January, 1988 upon arrival of the first shipment of shop fabricated panels. Final completion of the on-site contract work was established on April 22, 1988.

Appended to this report is a copy of a paper to be delivered by Dr. J.D. Chase at the Third Chemical Congress of North America in Toronto, June 1988. This paper describes the coprocessing pilot plant, its objectives and general operating parameters. It is enclosed herewith for information.

CONTRACTOR

The Cambrian Engineering Group Limited
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

Contact: Mr. Brian R. Emery, P.Eng.,
Vice President, Eastern Region.

Telephone: (416) 858-8010
Telefax: (416) 858-3332

SUBCONTRACTOR

Kennedy Electric Limited
201 Wilkinson Road
Brampton, Ontario, L6T 4M2

Contact: Mr. Norm Mihan,
President.

Telephone: (416) 450-1306
Telefax: (416) 450-3869

PANEL FABRICATOR

Custom Control Panels Limited
1686 Mattawa Avenue
Mississauga, Ontario, L4X 1K2

Contact: Mr. Anil K. Bhalla, P.Eng.

Telephone: (416) 279-6271
Telefax: (416) 279-6564

TECHNICAL DISCUSSION

The work of this contract was based on panel drawings, layouts and loop sheets prepared under a previous separate 1986 contract to Monenco Consultants Limited. The scope of the Cambrian contract was described in tasks as follows:

Task 1 • fabricate instrumentation and control panels utilizing free issue materials provided by EMR

Task 2 • prepare a technical specification detailing conduit and wiring requirements

Task 3 • issue instructions to the installing subcontractor

Task 4 • install wiring between instrument panels and field terminal blocks

Task 5 • complete instrumentation wiring between panels and locally installed sensors/devices

Task 6 • perform continuity testing for all loops and installed circuitry with EMR representative

Task 1 was completed with sequential deliveries to the site of panels as completed. One major change was made to revise the power supply to panels from 120/1/60 to a three phase system. Additional circuit panels with breakers and fuses on heater circuits were added. The contractor initiated a change to thermocouple junction boxes, reducing ten (10) smaller boxes to two (2) larger boxes. The change was proposed to provide space for future additions, to provide for better maintenance accessibility and to reduce conduit congestion in what was an area limited in available mounting space.

Task 2 is the technical specification for conduit and wiring installations. A copy of the specification is appended to this report. The contractor initiated a change from Crouse-Hinds wiring junction boxes to Killark junction boxes on account of the excessive delivery schedule for the Crouse-Hinds materials. Other minor materials substitutions were similarly made in order to expedite completion of the work.

Task 3 was predetermined at the time of proposal submission, Kennedy Electric Limited having been named as the installing subcontractor. The work of Task 2 was transmitted to Kennedy Electric Limited for implementation.

Tasks 4 and 5 were the field wiring and installation phases of the contract work. An effort was made by the contractor to increase the crew size, space permitting, to facilitate completion of the on-site work within the contract time.

Concerns were raised by the Ontario Hydro Inspector, Mr.Robert Dunk, regarding area classifications and non-conforming existing installations in the immediate vicinity of the new contract work. Hazard classifications for the areas in which the contract work was undertaken were stipulated in the contract documents. EMR agreed that existing non-conforming electrical installations were their responsibility within the context of facilities management for the entire Bells Corners complex.

EMR are also responsible for obtaining special Ontario Hydro inspection of non-CSA approved instrumentation, primarily heaters, before placing the systems into active service.

Task 5, continuity testing for installed loops and circuits was performed area by area as completed. All testing was conducted with the able assistance of the EMR representative and a copy of his acceptance report is appended to this report.

CONCLUSIONS

The field installation was well received by the Canmet personnel as regards the quality of workmanship, neatness of detail and fitting of the work to a very confined area. The contractor too was pleased with the end result of the installation. Few deficiencies were noted during construction or during continuity testing. Working closely with EMR personnel on a daily basis facilitated detection and correction of detailed fitting work so as to minimize the time required at the end of the construction period in corrective work. This close working relationship also made easier the turn-over of the installation to EMR as they were well familiar with all of the details pertaining to the physical elements of the work.

Scheduling of the work to coincide completion with the fiscal year end was difficult. Changes to panels during fabrication caused delays which became critical near the conclusion of the on-site work. The contractor was able to greatly increase the installing crew size, peaking at nine, to compensate for time lost in the panel fabrication stage of the contract.

Panel changes were necessitated by some changes initiated from EMR due to further process modifications and by deviations from the Monenco documentation upon which the contract was based.

Two amendments to the contract price were approved during the course of the contract. The first involved panel detail changes during fabrication. The second price amendment was for materials procurement and some minor field modifications initiated by process changes developed by EMR.

During the field installation contract work, a disagreement arose between the contractor and the Scientific Authority regarding the level of on-site technical and management

supervision being provided to expedite the work to completion. While the statement of work covers this topic, it may be open to interpretation as to how supervision will be implemented. The contractor took the position that the site foreman of his sub-contract was providing adequate day-to-day co-ordination of the installation with support and frequent communications from his office as well as that of the prime contractor.

Observations worth noting are the potential for conflict between the contractor and end user (EMR) resulting from (a) the contracting procedures utilized by DSS, and (b) the existence of a special relationship between contractor and sub-contractor.

A good example of the former is the level of supervision expected by EMR versus that actually provided by the contractor. From the contractor's perspective, when providing a fixed price offer in a competitive environment, the most cost effective method will be preferred in order to secure the contract. Once a contract has been won, the contractor has the incentive to execute the work in the manner anticipated in his priced proposal, while of course abiding by conditions laid down in the contract. We would recommend that the statement of work issued with the RFP be more specific regarding those areas which may be subject to interpretation. In this instance, if continuous site supervision was desired, the word continuous should have been stipulated thus ensuring that each priced proposal contained this element and that the Scientific Authority would have the right to insist on the stated site supervision requirement.

Another difficulty experienced by the contractor was obtaining approval for contract price amendments in a timely fashion. It is not unusual for deviations to exist between the detailed documentation, upon which the contract price is based, and the actual requirements of the work. With the limited time frame for execution of the contract work, it was not possible to

wait for the DSS approval of price amendments before proceeding with changes. In practice, the contractor proceeded with changes, at his peril, but with the understanding that EMR would support the application for additional funding of the project. While these may not be major cost items, if the contractor chose to follow the procedure for application for a price adjustment, the job completion schedule would have to have been sacrificed in order that the contractor protect his financial position within the contract. We recommend that contract price change procedures be reviewed with the objective of streamlining the approval routine so as not to jeopardize work schedules in those instances where changes are inevitable.

APPENDICES

DISCLOSURE CERTIFICATION

Mrs. Maureen Renaud
Science Procurement Officer
Science and Professional
Services Directorate
Science Branch
Department of Supply and Services
Place du Portage, Phase III, 11C1
11 Laurier Street
Hull, Quebec
K1A 0S5

CONTRACT TITLE: CONSTRUCT AND INSTALL A PILOT PLANT ELECTRONIC INSTRUMENTATION SYSTEM

CONTRACT FILE NUMBER: 14SQ.23440-7-9006

CONTRACT SERIAL NUMBER: 23440-7-9006/01-SQ

CANMET PROJECT NO.: 504102-01

We certify that there are no disclosures to submit under the above referenced contract, referred to in General Conditions Research and Development.

SIGNATURE

NAME: BRIAN R. EMERY, P.ENG.

TITLE: VICE PRESIDENT - EASTERN REGION

COMPANY NAME: THE CAMBRIAN ENGINEERING GROUP LIMITED

DATE: May 24, 1988

8990

ONTARIO HYDRO
ELECTRICAL INSPECTION DEPARTMENT
CERTIFICATE OF INSPECTION

**** THIS IS NOT AN INVOICE ****

Applicant:

KENNEDY ELECTRIC
201 WILKINSON ROAD
BRAMPTON ONTARIO
L6T 4M2

APR 27 1988

Date of Issue: 04-22-88
Order Number: 40204
Inspection Fee: 114.20

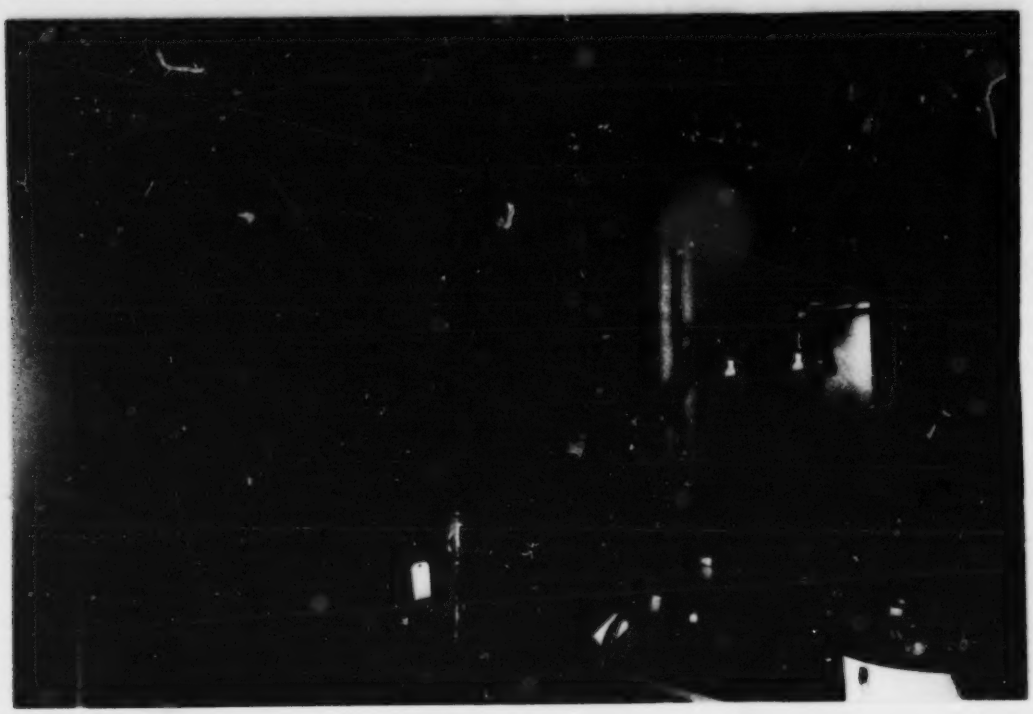
Inst. Name: ENERY MINES & RESOURCES CANMET
Address : BLDG 4 BELLS CORNERS

Local Office:
Ottawa Inspection Office
105 Colonnade Road North
Nepean, Ontario
K2E 7L6 613-225-7600

Hereby gives notice that the electrical inspection for the installation (or part of installation) described hereon has been completed.

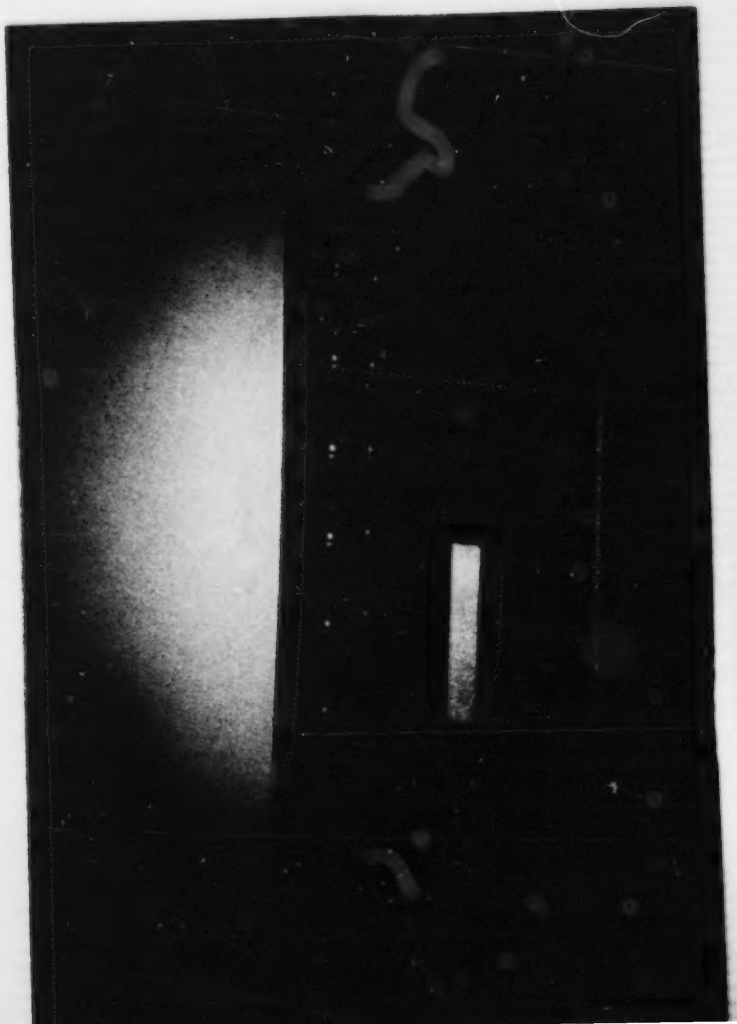
Type: Wiring-Add/Alt Premises: 0

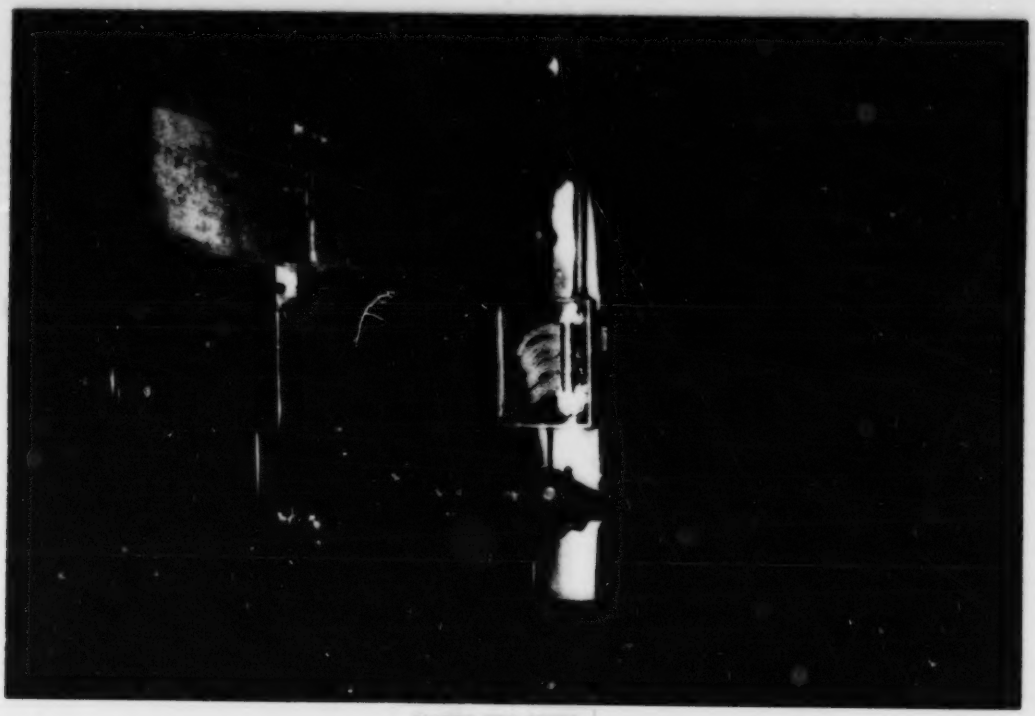
Description	Quantity	Fee
SOLINOIDS & THERMOCOUPLE HOOK UP	200	114.20
		114.20



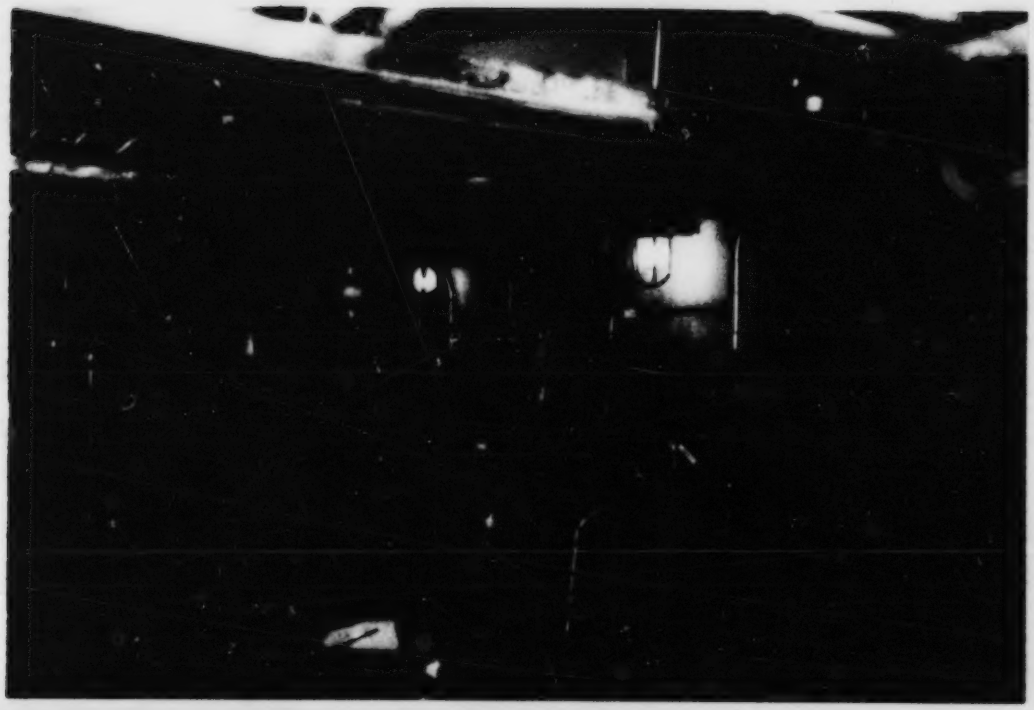
SLURRY AREA - COAL HANDLING

SLURRY AREA - PANEL 'S'

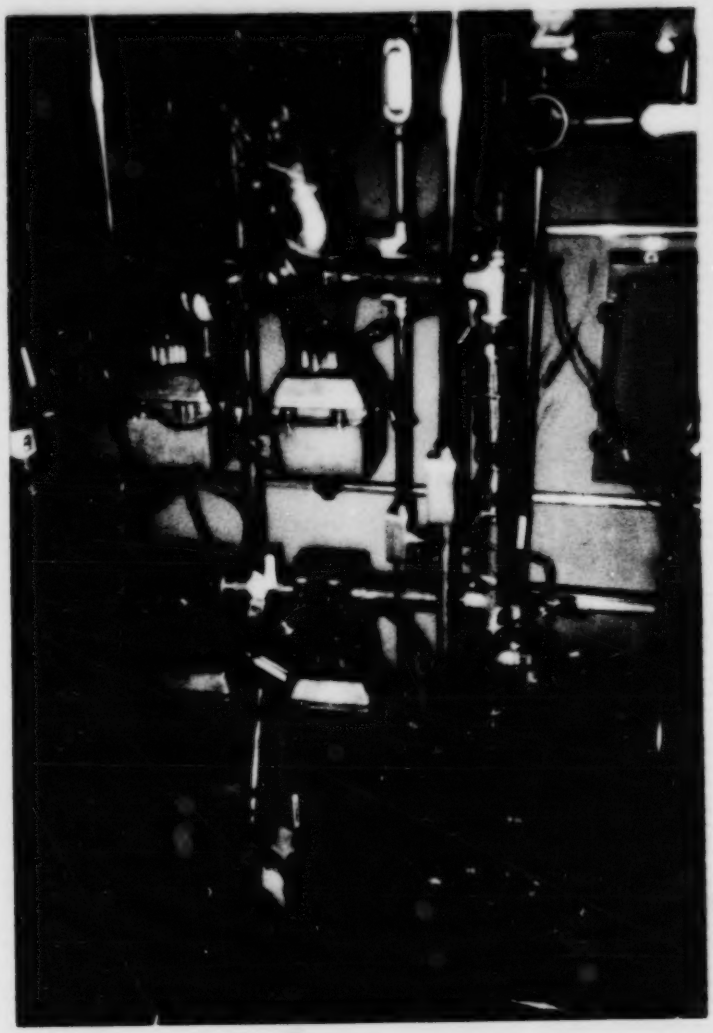




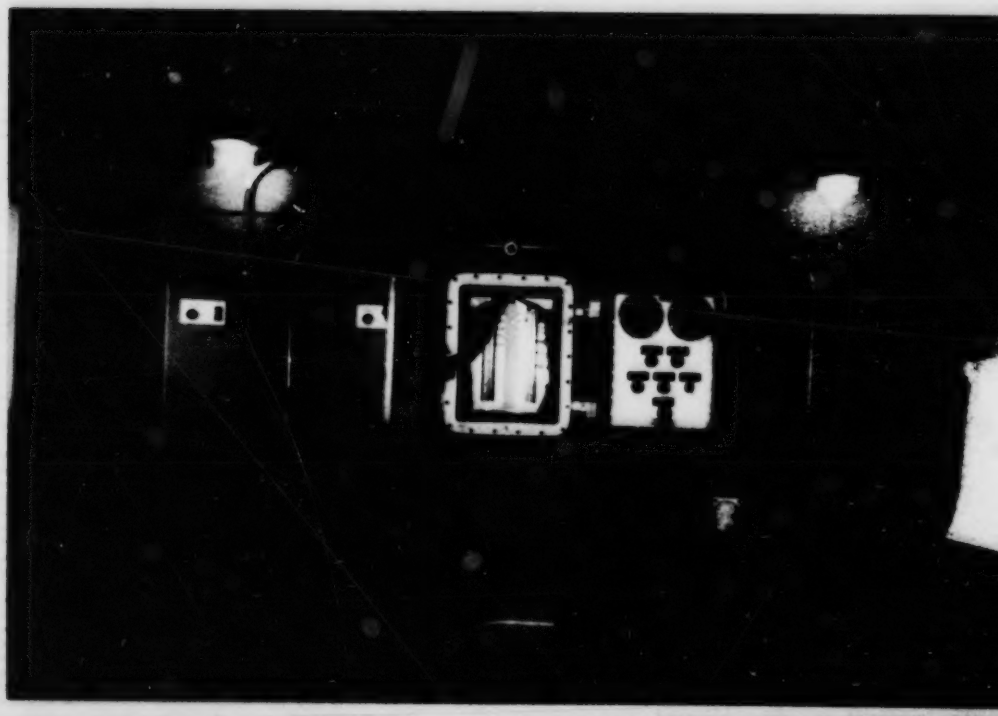
SLURRY MIX TANKS



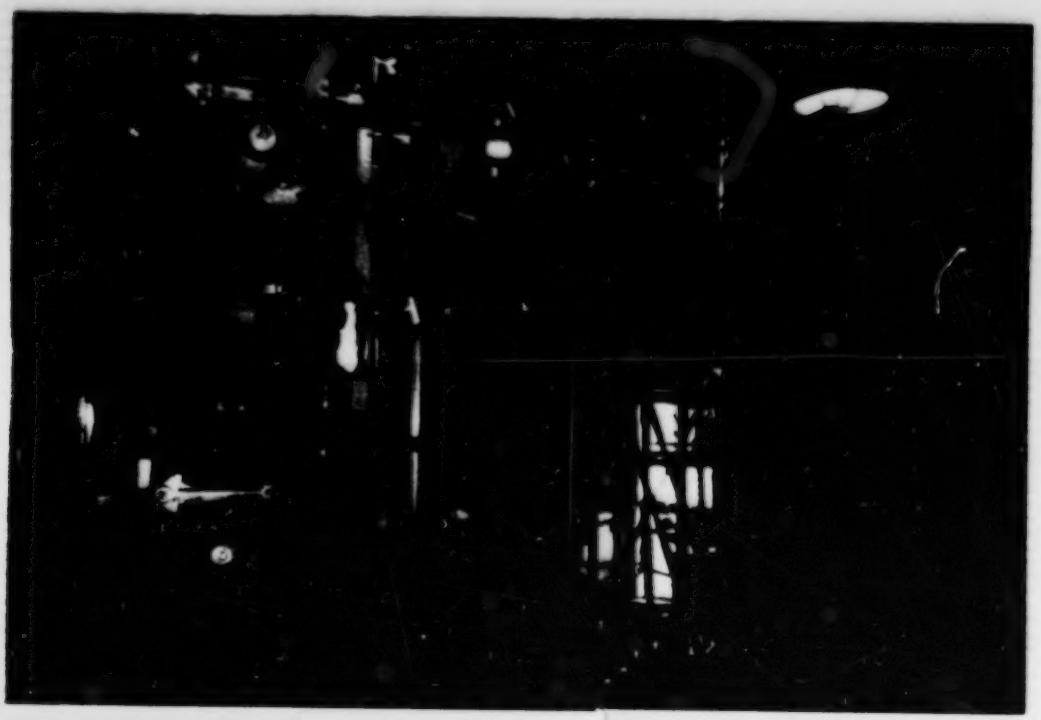
SLURRY TANK AGITATORS



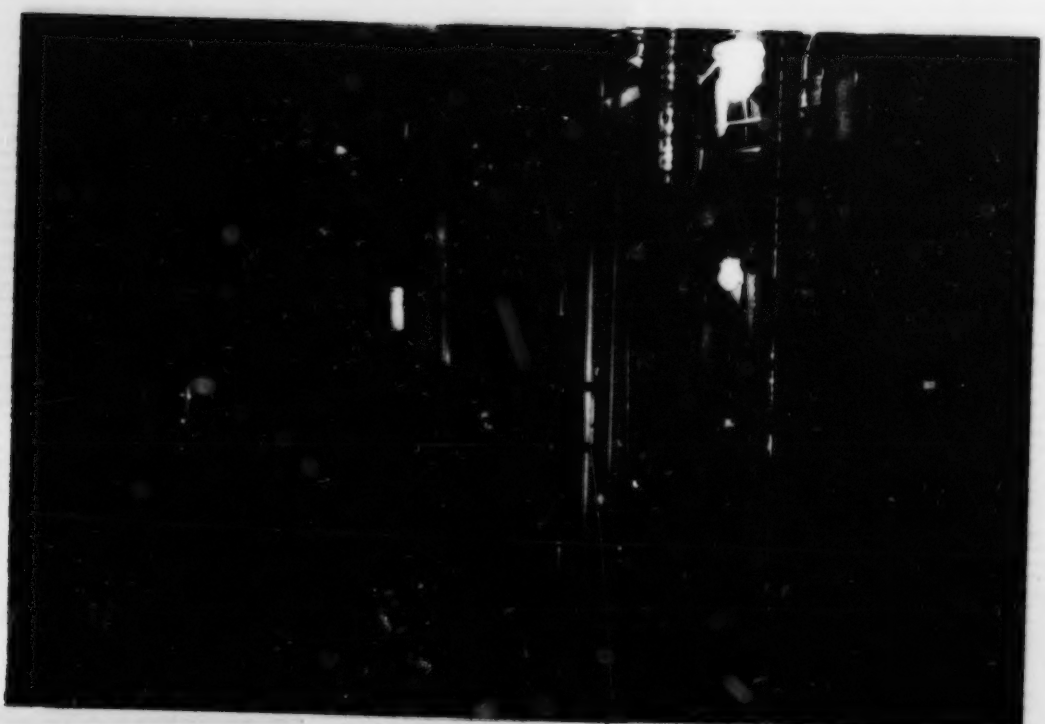
SLURRY AREA - SELECTOR VALVES



SLURRY AREA - DC SPEED CONTROLLERS/
SELECTOR VALVE SWITCHES



PILOT PLANT 3 - REACTORS
LOWER LEVEL



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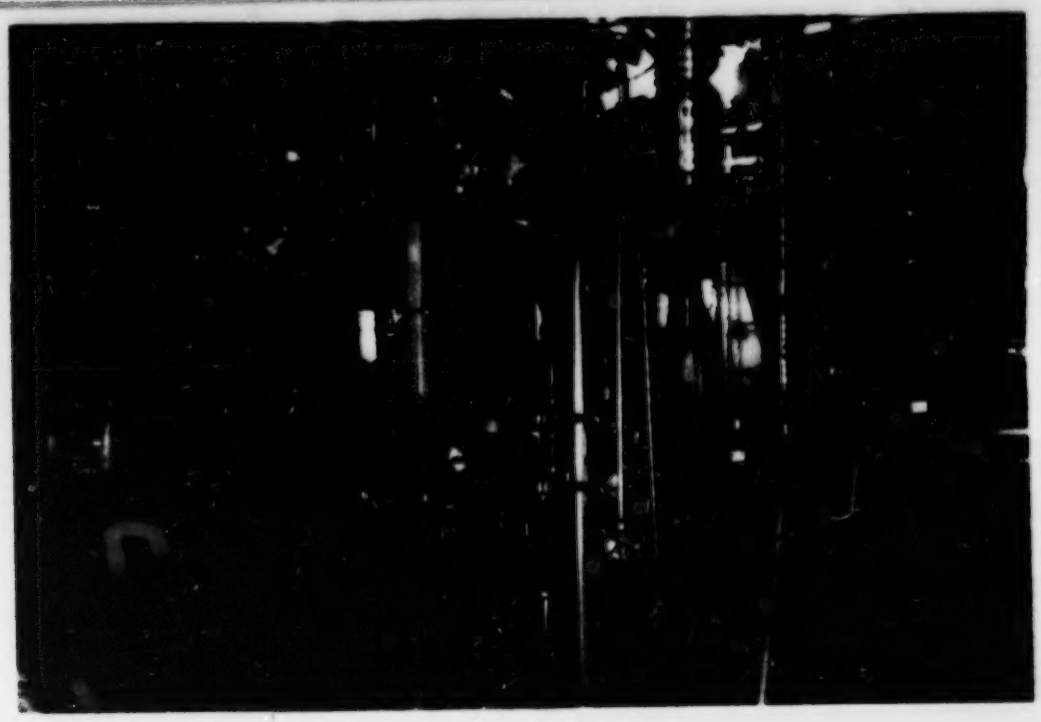
LOWER LEVEL



PILOT PLANT 3 - REACTORS
LOWER LEVEL

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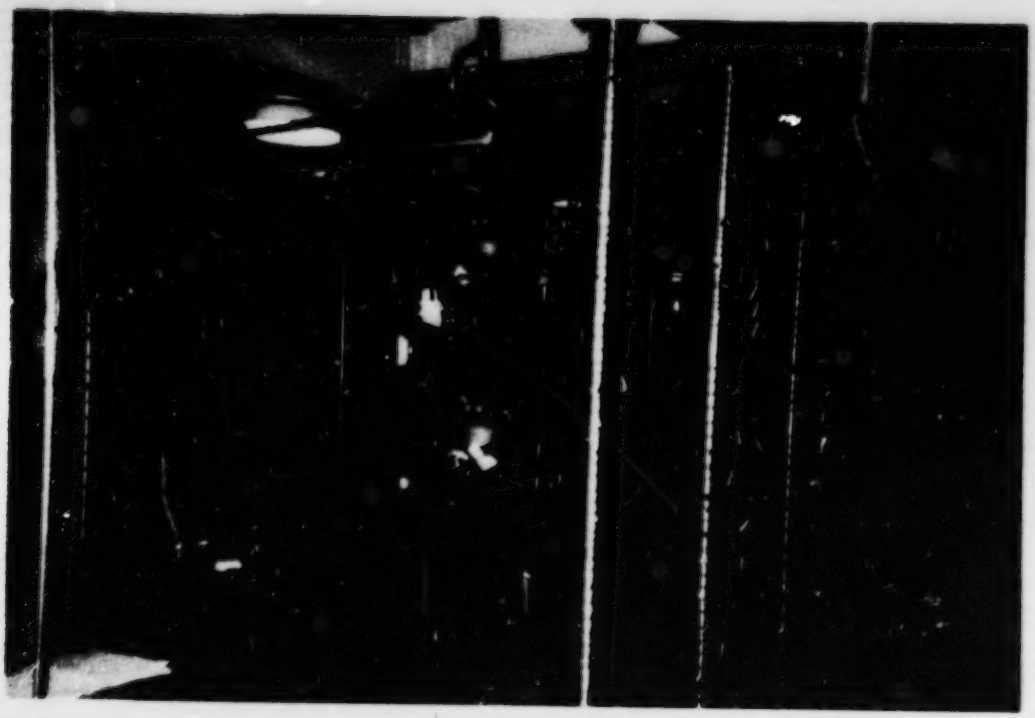
LOWER LEVEL



PILOT PLANT 3 - REACTORS
INTERMEDIATE LEVEL

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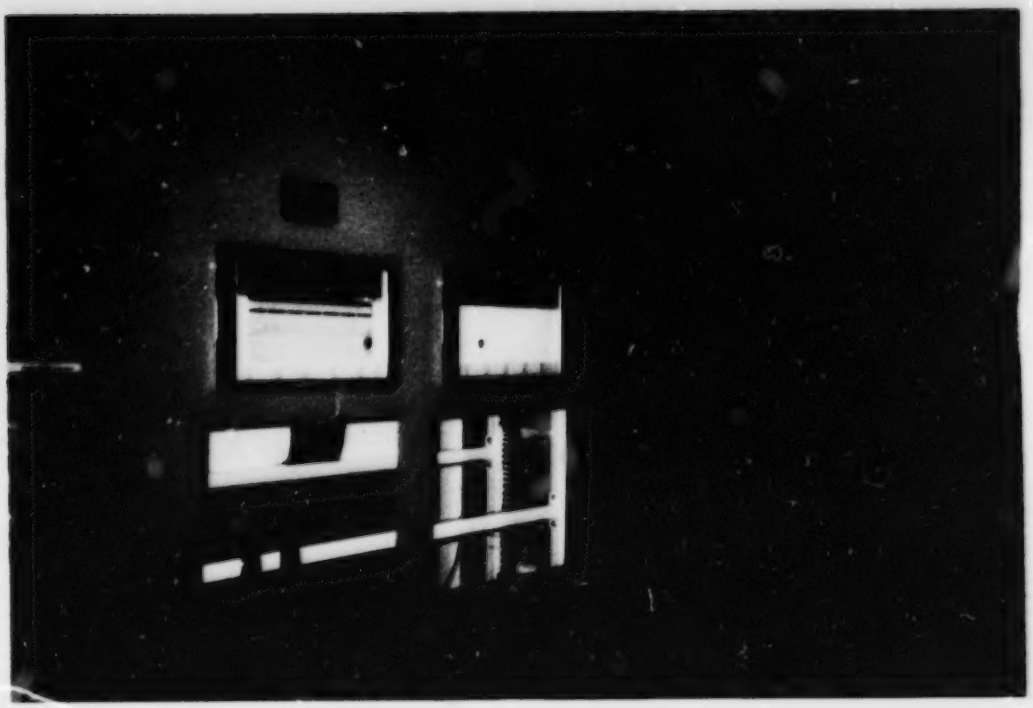
INTERMEDIATE LEVEL



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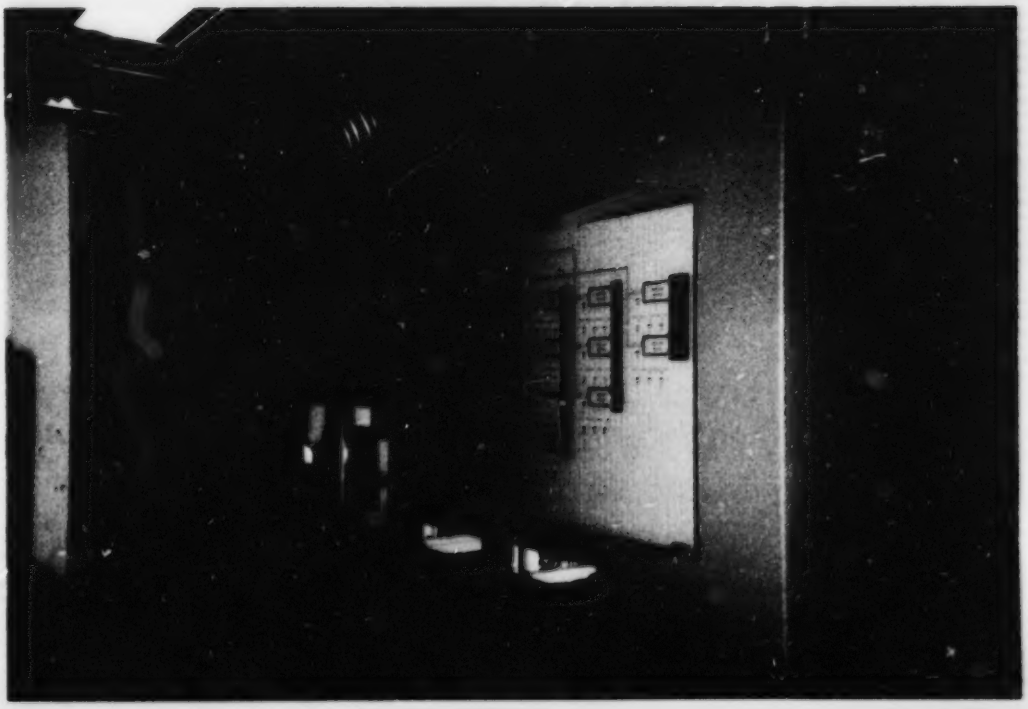

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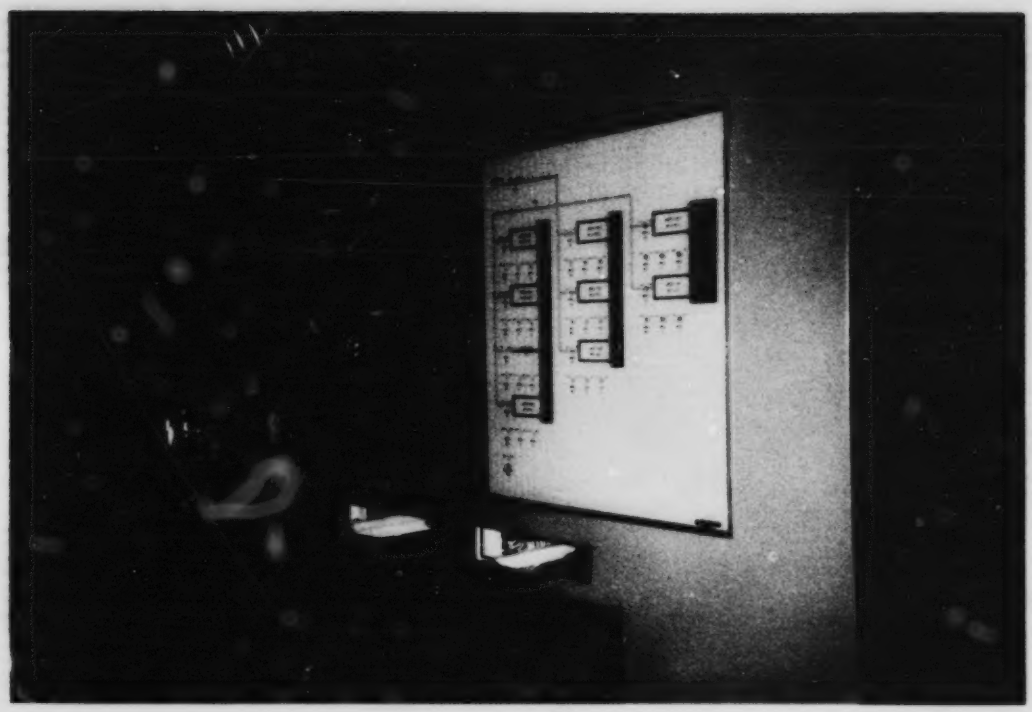

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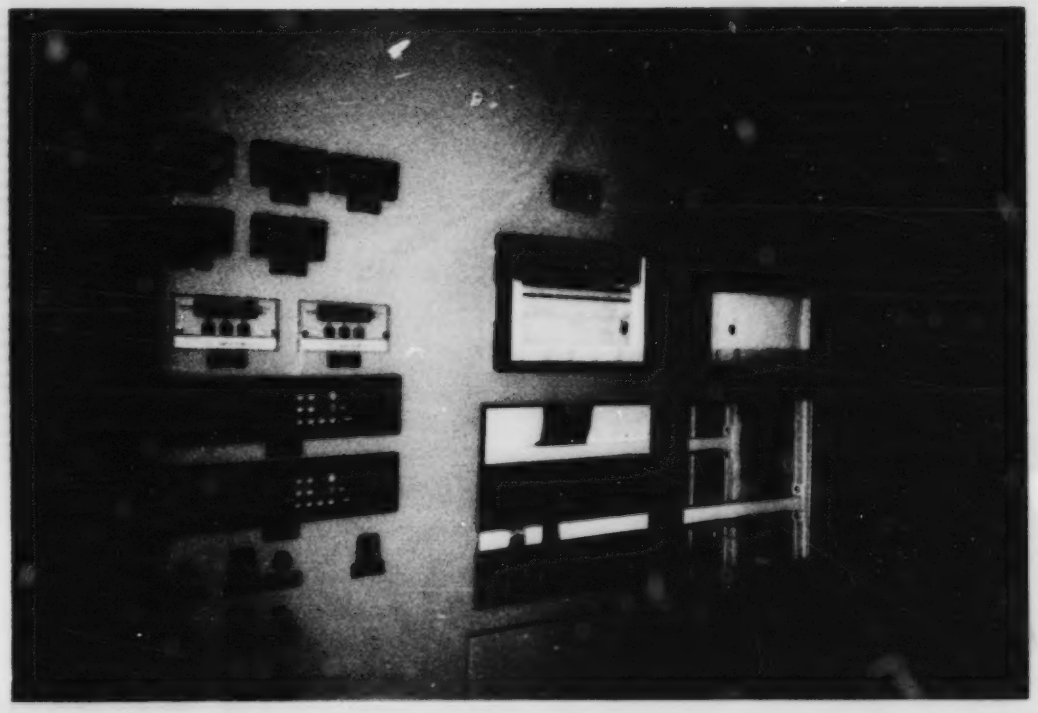

PANEL 'A-1'

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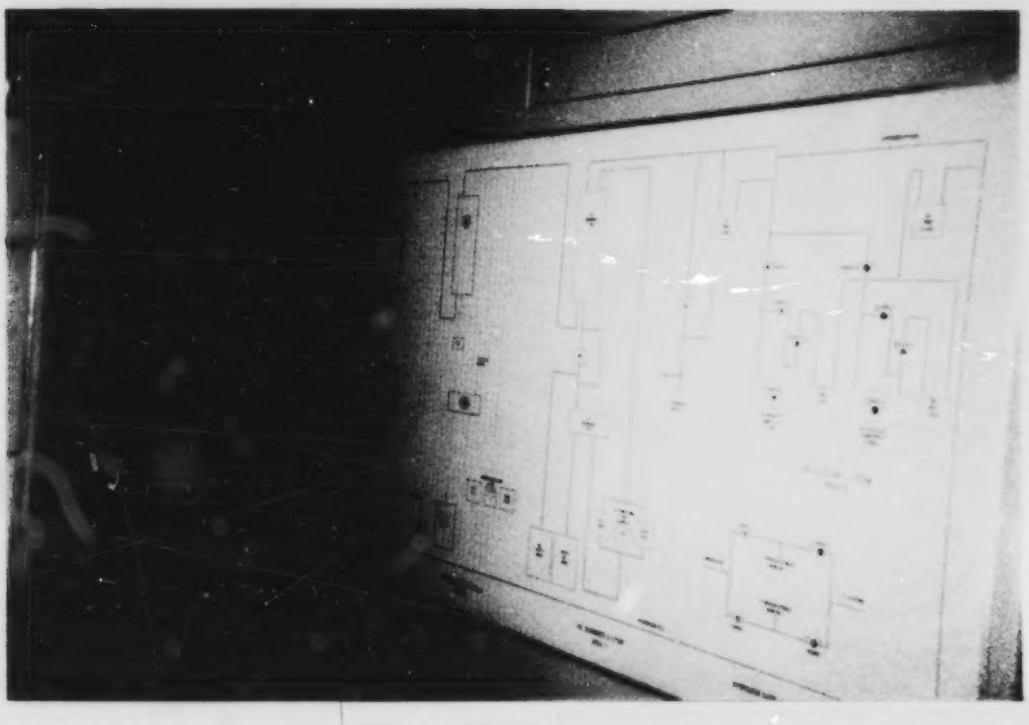

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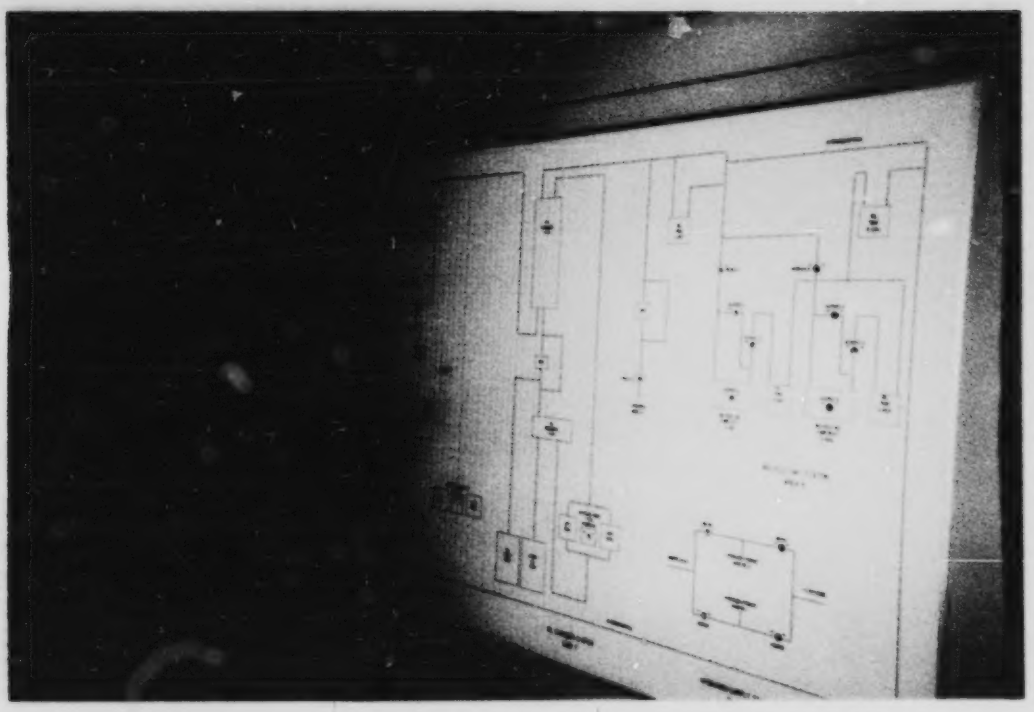

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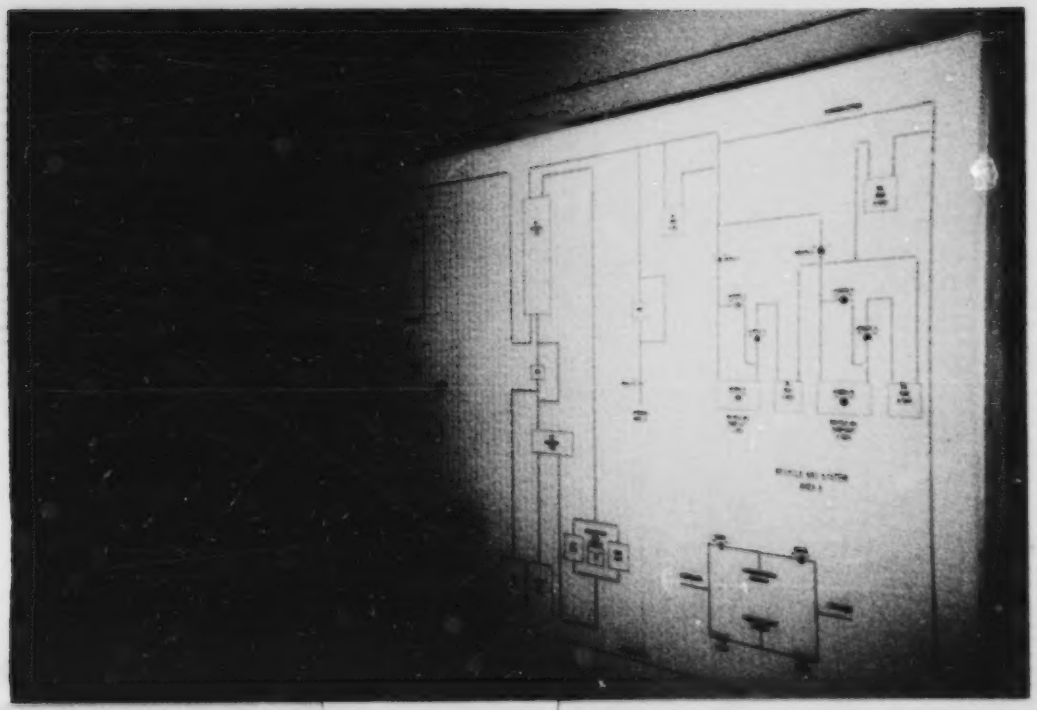

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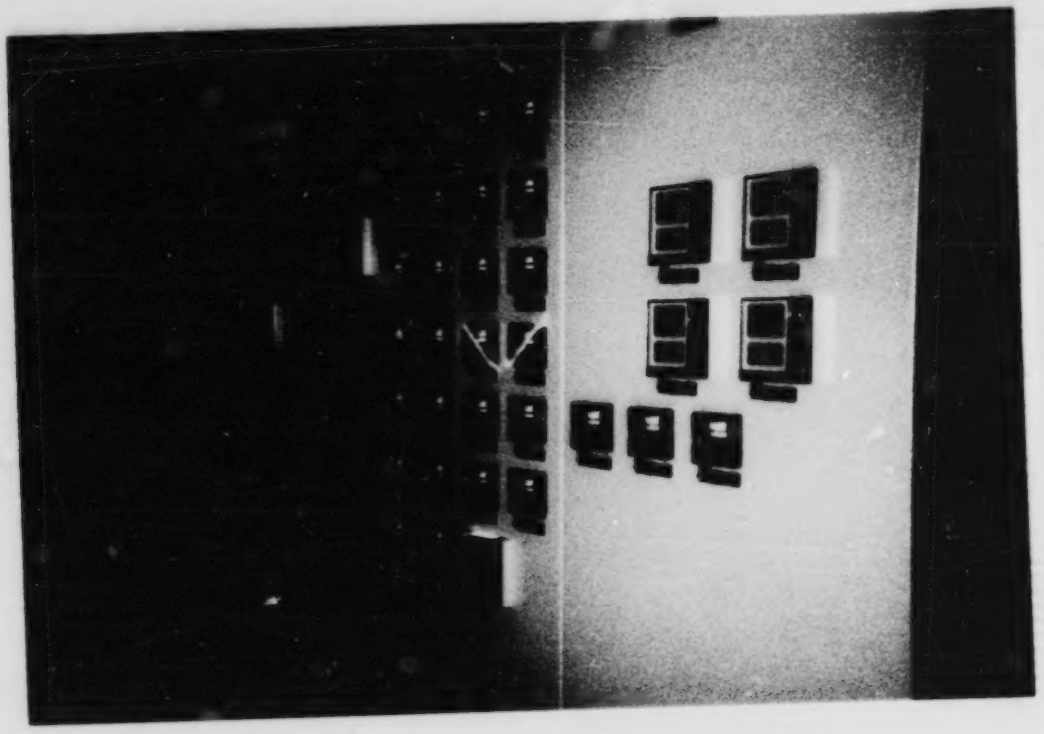
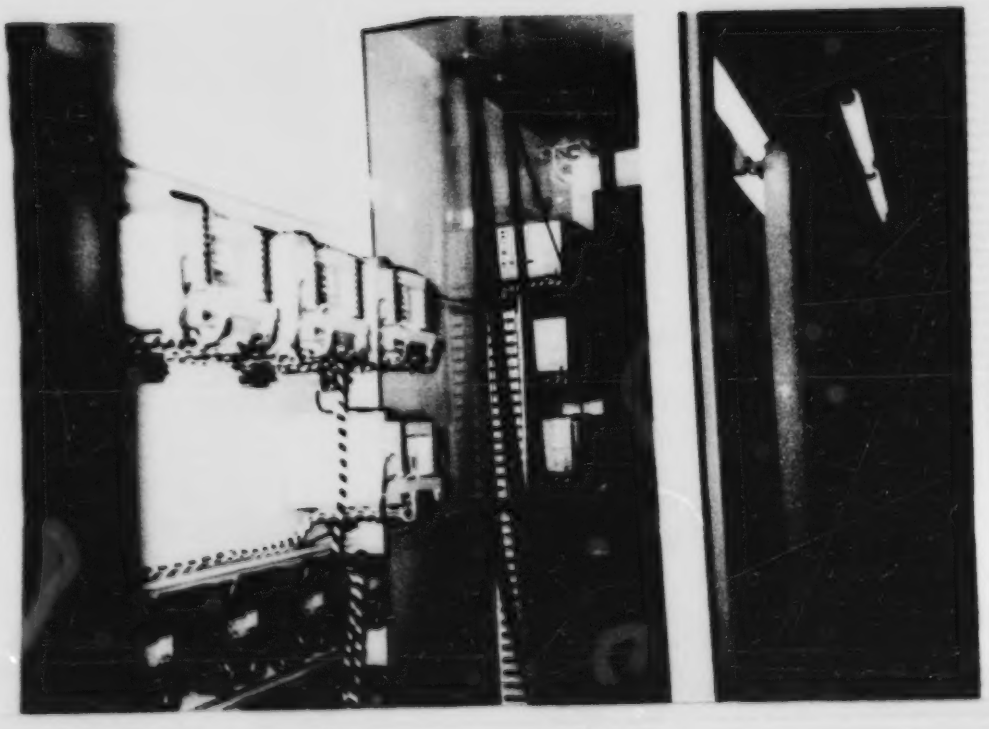


PANEL 'C'



PANEL 'C' - REAR VIEW

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

MEMORANDUM NO: 1.
DATE: November 19, 1987
CEG PROJECT NO: D35.6
CLIENT PROJECT NO:

TO: EMR
Bells Corners
Attn: Dr. J. Chase

REF: Cont.No.14SQ.23440-7-9006
Pilot Plant Electronic
Instrumentation Installation

MEETING HELD AT: CEG Offices, Mississauga
DATE OF MEETING: November 17/18, 1987

PRESENT:

Chas. McNabb	-	EMR
G. Kluke	-	EMR
R. Zabiela	-	KEL
J. Looi	-	CEG
B. Emery	-	CEG

ACTION BY

1.1 The purpose of the meeting was to conduct the 50% inspection of panel fabrication and to discuss technical details of both panels and field installations. — Info

1.2 Based on discussions with the panel fabrication group, the following delivery information was tabled: — Info

- mid-December - ship panels D1, D2, S and all junction boxes
- mid-January - ship panels A1, A2 and C

Graphics drawings were reviewed and approved by EMR and returned to Cambrian. Approximately 6 weeks delivery time is required for panel graphics. — Info

EMR staff requested two weeks notice for final shop inspection and verification testing on panels prior to shipping to site. — CEG

PP3 will not be ready for field installation work until January.

1.3 EMR confirmed that 3 phase power available on site is 208V 3ph 4 wire. — Info

1.4 Modifications for panel instrument arrangements in D1 and D2 were discussed. A priced proposal wil be submitted for consideration. — CEG

Power supply to both D1 and D2 should be 208 volts, 3 phase, 4 wire, 100 amp Square 'D' breaker panel with 42 circuits. This will be indicated in the price proposal. — CEG

1.5 Panel A-1 power supply will be revised to 208 volt, 3 phase, 4 wire,

ACTION BY

30 amp breaker from 115 VOLT AC 60 amp. Circuit fusing will be revised as follows:

- 6 receptacles - 15A
- solenoids - 15A
- DC drive - single fuse
- 10V and 24V DC power - single fuse
- 110 volt devices - individually fused

Cost implications will be noted in a proposal for contract change. CEG

1.6 Panel A-2 (mimic panel) power supply will remain 115 VOLT AC 30 amp. A 15 amp circuit breaker is required for receptacles. Group fusing for solenoids is not acceptable. Control wiring will be red, not black, as indicated. Power wiring will remain black. CEG

1.7 Panel C is proposed to have a 208 volt, 3 phase, 30 amp power supply rather than the indicated 115 Volt AC 60 amp. Circuit fusing requirements were discussed as follows: CEG

- 30 Barber Coleman devices - group as 3 x 15 A fuses
- 65 Athena devices - individual 3 A fuses (heater sections)
- group neutrals to one splitter block for circuit distribution

A price proposal for these modifications will be prepared.

1.8 Panel S power supply is proposed to change to 208 volt, 3 phase, 4 wire.

EMR will provide individual heater loads for fuse sizing. EMR

Heaters Nos. 4,5,6,15,16 and 17 for tanks are noted 115 Volt AC but may be 208V. EMR to confirm. EMR

Heaters Nos. 24 and 25 are noted 208V but may be 115 volt. EMR to confirm. EMR

Fusing requirements for panels have not been indicated. The following was suggested: Info

Heaters	- individual circuit breakers
Valve Relay Sections	- 2 groups
Control Instrument Sections	- 3 groups
Receptacles	- 15 amp
PLC - Modules/CPU	- separate (2 x 15 amp)
Panel Lighting	- separate

1.9 Revisions to Monenco drawings and loop diagrams are to be made by EMR (e.g. wire numbers). EMR

ACTION BY

1.10 The following questions and clarifications were raised: Info

a) Q: No wire numbers are shown from heaters to SCR's.
A: Use heater tag number as wire number.

b) Q: No wire numbers are shown from RPU.
A: Number as RPU with pairs identified and device number shown.

c) Q: Panel C heater 03TY4017 has no SCR listing.
A: Add SCR to panel D2, slot 15. EMR will provide SCR required.

d) Q: Monenco loop diagram registration No.203960 wire from TB3 to TB23 should read pair 14 not pair 15.
A: Agreed.

e) Q: Loop OITY4009 is not shown on J.B. #1B.
A: This was added later and should be noted for J.B. #1B.

f) Q: Some Monenco loop sheets marked "Deleted".
A: Yes, these are deleted and are included for completeness.

g) Q: Mixer motor statatrol in panel 5 terminal blocks deleted.
A: EMR will confirm if device safe for use in this area and if TB's required.

1.11 Preliminary drawings for general arrangement, instrument location, conduit routing etc. were reviewed. Info

EMR will provide instrument numbers for locations indicated. EMR

B.R. Emery, P.Eng.
BRE/mlm

cc: C. McNabb - EMR
M. Renaud - DSS
R. Zabiela - KEL

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

MEMORANDUM NO: 2
DATE: February 2, 1988
CEG PROJECT NO: D35.6
CLIENT PROJECT NO:

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

TO: EMR, SFRL
Bells Corners
Attention: Dr. J. D. Chase

REF: Cont. No. 14SQ.23440-7-9006
Pilot Plant Electronic Instrumentation Installation

MEETING HELD AT: EMR, Bells Corner

DATE OF MEETING: February 1, 1988

PRESENT: Messrs. J. D. Chase - EMR
C. A. McNabb - EMR
N. Ouellette - KEL
R. Zabiela - KEL
B. Emery - CEG

ACTION BY

2.1 The meeting was scheduled as the first of regularly convened site progress and review meetings to ensure conformance of the contract work during field installations. Info

2.2 Two (2) sets of 'C' sized installation drawings were handed to EMR. Info

2.3 EMR advised that PP1 may begin a run on March 15. Typical pilot plant runs are 21 days duration. No source of ignition work (e.g. drilling, cutting) is permitted in the area during pilot plant runs. Info

2.4 The EMR minutes of the January 15 meeting were reviewed and generally accepted. Info

2.5 Panel deliveries are now dependent on receipt of the graphics panel and switches. Some detailed wiring questions remain to be resolved by EMR. The tentative shipping date is February 15. A partial shipment may be made so as not to delay site wiring work. EMR will not require shop inspections prior to shipping. CEG

2.6 EMR requested that the contractor advise when they are being held up by site conditions. CEG

Cambrian advised that some delay in panel fabrication was due to graphics changes. Tagging and mounting of instruments will have to preceed the field wiring activities. CEG

ACTION BY

2.7 Tagging of field instruments is proceeding. Solenoids and mounted instruments are tagged. Some instruments are not yet mounted. Heaters for reactors will be completed by February 8, tagging to follow. Within two weeks, all heaters and thermocouples will be completed and tagged. EMR

2.8 Some new instruments (e.g. solenoids/heaters) have been added to the hot catchpot in the slurry area. It was agreed that separate time and material records would be kept for out-of-scope work to be acknowledged by EMR. CEG

2.9 The installing crew will be increased to 4 as of February 8. It may be possible to have 6 installers on site when the balance of the panels have been received. CEG

2.10 It was requested that base channels from panel A1 be removed to permit clearance for pipe insulation passing above the panel. CEG

2.11 The contractor requested that the slurry area be the first priority for tagging by EMR. Info

Two statotrol DCR drive panels are not rated for this area but will be air purged. Power wiring will be installed by EMR. There is no instrument wiring to panels from the driver controllers. EMR

EMR are arranging for heater junction boxes on the two slurry mix tanks. EMR

ISL, ISR, 1A, 1B and 2A junction boxes are required on site to complete the slurry area wiring. CEG

2.12 The contractor advised that there may be a cost extra for thermocouple wiring changes on panel C. This will be reviewed and, if necessary, will be forwarded as a request for approval. CEG

2.13 The next meeting was scheduled for Tuesday, February 16, pending panel delivery timing. Info

B.R. Emery, P. Eng.
Vice President

BRE/jb

cc: R. Zabiela - KEL

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

MEMORANDUM NO: 3
DATE: February 22,1988
CEG PROJECT NO: D35.6
CLIENT PROJECT NO:

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

TO: EMR. SFRL
Bells Corners
Attn: Dr. J.D. Chase

REF: Pilot Plant Electronic Instrumentation Installation Cont.No.14SQ.23440-7-9006

MEETING HELD AT: EMR, Bells Corners

DATE OF MEETING: February 17, 1988

PRESENT:

J.D. Chase	-	EMR
R. Loggie	-	EMR
C.A. McNabb	-	EMR
N. Mihan	-	KEL
N. Ouellette	-	KEL
J. Looi	-	TCEGL
B. Emery	-	TCEGL

		ACTION BY
3.1	The meeting was convened as a site progress review session. Previous meeting minutes were accepted as written.	Info
3.2	EMR advised that PP1 runs would not occur before April.	Info
3.3	EMR stressed that substantial completion of the installation was to be achieved by the end of March. Check out and documentation will follow the field installation stage of the contract.	TCEGL
3.4	Panel C arrived at the site mid morning of February 17. Panel A-1 will be shipped to arrive on site Feb. 22. Panel A-2 is scheduled for shipping Feb.26 to arrive on site Feb. 29.	TCEGL
3.5	A shipment of long awaited fittings arrived mid morning Feb. 17. The balance of fittings are to arrive by courier Feb. 19.	Info
3.6	The contractor will finish the slurry area by Feb. 26 pending arrival of the selector switches. A point-to-point checkout of the circuitry will follow for acceptance by EMR.	TCEGL
3.7	EMR have requested flex bends at heater conduit runs to the slurry tanks to avoid potential scale reading errors.	TCEGL

		ACTION BY
3.8	The contractor requested power supply to slurry area motors and panels D1, D2 and S by February 29. Power supply to the balance of panels is requested by March 15.	EMR
3.9	Panels D1 and D2 have been field located. This change will be noted in the "as built" final documentation.	TCEGL
3.10	Extended hours for field crew require co-ordination with EMR so that passes and EMR personnel can be made available. The field crews can work Friday afternoons (extra 4 hours) without the need for special arrangements.	Info
3.11	Tagging of instruments by EMR is progressing. Four points in the slurry area require clarification. Heaters, thermocouples and scrubber devices are proceeding.	EMR
3.12	Additional heaters for the hot catchpot will be removed. One and possibly three extra solenoid valves will be installed in the slurry area.	EMR
3.13	Panel A-1 will be shipped short of multi-pin plugs for scale indicators. These will be field installed.	TCEGL
3.14	A preliminary contact with Ontario Hydro inspection has been made. An inspection date of March 15 will be scheduled.	TCEGL
3.15	Present field crew size is three. Now that fittings have arrived an additional installer will be added.	TCEGL
3.16	The next meeting is scheduled for 10:00 a.m. March 1. It is intended that the slurry area check out will take place March 1 and 2.	TCEGL/ EMR

B.R. Emery, P.Eng.
BRE/mlm

cc: All present at meeting

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

MEMORANDUM NO: March 7, 1988
DATE: D35.6
CEG PROJECT NO:
CLIENT PROJECT NO:

TO: EMR - SFRL
Bells Corners
Attention: Dr. J. D. Chase

REF: Pilot Plant Electronic Instrumentation Installation
Contract No. 14SQ123440-7-9006

MEETING HELD AT: EMR, Bells Corners

DATE OF MEETING: March 1, 1988

PRESENT:

J. D. Chase	- EMR
R. Logie	- EMR
C. A. McNabb	- EMR
L. Mysak	- EMR
N. Ouellette	- KEL
J. Looi	- CEG
B. R. Emery	- CEG

		ACTION BY
4.1	The meeting was convened as a site progress review session. Previous meeting minutes were accepted as written.	Info
4.2	CEG stated that substantial completion of the contract could be achieved by the end of March. Some check out and documentation activities would follow into April.	CEG
4.3	Flex bends at heater conduit runs to slurry tanks have been installed as requested by EMR.	Info
4.4	EMR confirmed that non-shielded thermocouple wire was acceptable for field run wire as this is consistent with wire supplied by EMR.	Info
4.5	Excess instrumentation has been returned to the site from the panel fabricator. This material will be turned over to EMR with a sign off list.	CEG
4.6	Panel A-1 arrived on-site February 29. Panel A-2 arrived on-site March 1, completing the delivery of shop fabricated items.	Info
4.7	Selector switches for graphics panels have been shipped and are being traced.	CEG
4.8	The slurry area point to point check out has been rescheduled to Wednesday, March 9.	CEG
4.9	Power supply to panels and motors will be provided by EMR. This work is expected to commence the week of March 4.	EMR

ACTION BY

4.10	The contractor has 5 personnel now working on-site. An additional installer will be added February 7. Field wiring should be 75% complete by March 11.	CEG
4.11	The slurry area instrument tagging is completed. Balance of instrument tagging will be done by March 4.	EMR
4.12	Preliminary Ontario Hydro inspection is still scheduled for March 15. Power connections will be required for final approval. CSA labelling for panels will be checked.	Info
4.13	Labelling to RPU junction boxes will be complete by Monday, March 7. J type terminal block strips are required for final connections.	EMR
4.14	EMR authorized CEG to supply 30 strips of 20 terminal blocks (J type) if a source of quick supply can be located.	CEG
4.15	CEG have questioned the logic/wiring detail for slurry area ball valve selector switches. The detailed drawings will be field reviewed after the meeting.	EMR/CEG
4.16	EMR are to provide female thermocouple terminations (jacks) for wiring connections.	EMR
4.17	Final documentation at the end of the contract is to include conduit runs in plans (2 sheets). Conduit terminations will be tagged with conduit numbers as shown on the drawings.	CEG
4.18	The next meeting was not specifically scheduled pending site progress. The week of March 14 will likely be a meeting period.	Info

B. R. Emery, P. Eng.
Vice President

BRE/jb

cc: R.Z. - KEL
All Present

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

MEMORANDUM NO: 5
DATE: March 25, 1988
CEG PROJECT NO: D35.6
CLIENT PROJECT NO:

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

TO: EMR - SFRL
Bells Corners
Attention: Dr. J. D. Chase

REF: Pilot Plant Electronic Instrumentation Installation
Contract No. 14SQ123440-7-9006

MEETING HELD AT: EMR, Bells Corners

DATE OF MEETING: March 15, 1988

PRESENT:

J. D. Chase	- EMR
C. A. McNabb	- EMR
R. Zabiela	- KEL
N. Ouellette	- KEL
J. Looi	- CEG

		ACTION BY
5.1	The meeting was convened as a site progress review session. Previous meeting minutes were accepted as written.	Info
5.2	Ontario Hydro Inspection is scheduled for the week of March 14, 1988.	CEG
5.3	Require Ontario Hydro Inspector's comments of 2 DC speed controllers enclosure in the slurry area.	EMR
5.4	Panel fabricator confirmed that all the panels are CSA approved. Only 3 CSA labels are missing. R.Z. - KEL, will send missing CSA labels to N.O. - KEL, at site.	CEG
5.5	Power supply to Panel 'S' is in progress.	EMR
5.6	EMR shall apply for Hydro Inspection on the power supply wiring to panels and motors.	EMR
5.7	Slurry Area point to point check-out was completed on March 14, 1988. No wiring errors were found.	EMR
5.8	C.A.M. - EMR, agreed to install amphenol connectors to Aurora Scales.	EMR
5.9	Process Area point to point check-out was scheduled for the week of March 28, 1988.	CEG
5.10	Thermocouple termination jacks were given to N.O. - KEL.	EMR/CEG
5.11	N.O. - KEL, stated that 95% completion of the contract could be achieved by the end of March. Process Area point to point check-out and some termination at panels would follow into 1st week of April.	CEG

5.12 N.O. - KEL, stated that 2 personnel will be on site the 1st week of April to complete the contract. CEG

5.13 The next meeting was not specifically scheduled. The week of March 28, 1988 will likely be a meeting period. Info

J. Looi

JL/jb

cc: All Present

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

MEMORANDUM NO: 6
DATE: March 30, 1988
CEG PROJECT NO: D35.6
CLIENT PROJECT NO:

TO: EMR. SFRL
Bells Corners
Attn: Dr. J.D. Chase

REF: Pilot Plant Electronic Instrumentation Installation
Cont.No.14SQ.23440-7-9006

MEETING HELD AT: EMR, Bells Corners

DATE OF MEETING: March 29, 1988

PRESENT:

John Denis (part-time)	- EMR
J.D. Chase	- EMR
C.A. McNabb	- EMR
L. Mysak	- EMR
R. Logie	- EMR
N. Ouelette	- KEL
J. Looi	- TCEGL
B. Emery	- TCEGL

ACTION BY

6.1 The meeting was convened as a site progress review session. Previous meeting minutes were accepted as written. — Info

6.2 The contractor has issued invoice claim No.4 up to milestone No.7. An information copy was handed to J.D. Chase. — Info

If permissible, an invoice for 60% of milestone No.8 and for contract amendment No.1 will be issued by the end of the fiscal year. — TCEGL

6.3 Outstanding contract work was identified as follows: — TCEGL

- replace selector switches in slurry area
- panel pushbutton switches
- CSA labelling of panels
- Ontario Hydro inspection
- final documentation; report/drawings
- point to point check out
- conduit seals and covers

6.4 Authorization was received at the meeting to order Allen Bradley selector switch contact block assemblies (10) in lieu of original Crouse Hinds equipment. — TCEGL

Subsequent to the meeting the switch assemblies were ordered.

		ACTION BY
6.5	Contemplated Change Order No.2 was reviewed for acceptance. Item No.3 was reduced by $1,000 to $1,745.04 upon acceptance of the Allen Bradley substitution.	Info
6.6	EMR will provide a form acknowledging acceptance of point to point wiring check outs by areas. The slurry area was completed on March 14.	Info
6.7	The contractor confirmed that substantial performance of the contract would be attained by March 31. The present site crew size is 9. The installation group will be reduced to 3-4 as of April 5.	Info
6.8	Some thermocouples remain to be installed in the main processing area.	EMR
6.9	The contractor requested a general inspection of the installation so that any corrective work could be finished promptly.	EMR
6.10	One RS232 connector for the printer is required.	EMR
6.11	Power supply to the panels and motors is underway by TSD and Black Electric.	Info
6.12	Free issue material returned from the panel fabricator will will be turned over to EMR.	TCEGL
6.13	One additional conduit run to an upper level solenoid valve is required.	TCEGL
6.14	Transducer panel B-1 terminations are by EMR. The contractor provided wiring to the panel.	TCEGL
6.15	N.O. raised a potential problem with power lockout provision from phase amps to heaters. Subsequent to the meeting the Ontario Hydro Inspector confirmed that lockout provision was <u>not</u> required.	Info
6.16	Keys for various panels and access doors will be assembled, labelled and turned over to EMR.	TCEGL
6.17	No pilot plant runs are scheduled until the end of April.	Info
6.18	Floor penetrations for conduit runs are to be filled with grout.	TCEGL
6.19	Subsequent to the meeting, Mr. Bob Dunk of Ontario Hydro Inspection Branch visited the site. He reviewed the installation by the contractor and gave a general verbal	Info

6.19	Cont'd.	**ACTION BY**
	acceptance of the materials, methods and procedures being used. He expressed reservation over area classifications and existing installations that did not conform to current codes.	
	It was agreed that Bob Dunk will return the week of April 18 for a final inspection of the contract work. He indicated that a report covering TCEGL contract work could be issued.	TCEGL
6.20	There was no schedule established for future meetings.	Info.

B.R. Emery, P.Eng.
BRE/mlm

cc: All present
KEL - RZ

THE CAMBRIAN ENGINEERING GROUP LIMITED
2200 Argentia Road
Mississauga, Ontario, L5N 2K7

MEMORANDUM NO: 7
DATE: April 28, 1988
CEG PROJECT NO: D35.6
CLIENT PROJECT NO:

The purpose of this memorandum is to request or record information, decisions and other data in connection with reports, investigations, or the design and preparation of Contract Documents or to record minutes of meetings for the above project.

TO: EMR-SFRL
Bells Corners
Attention: Dr. J.D. Chase

REF: Pilot Plant Electronic Instrumentation Install'n
Contract No.14SQ.23440-7-9006

MEETING HELD AT: EMR, Bells Corners

DATE OF MEETING: April 22 1988

PRESENT:

J.D.Chase	-	EMR
C.A. McNabb	-	"
R. Logie	-	"
G. Kluke	-	"
L. Mysak	-	"
N. Ouelette	-	KEL
N. Mihan	-	"
B.R. Emery	-	TCEGL

		ACTION BY
7.1	The meeting was convened as the final on-site review of the contract work.	Info
7.2	Invoicing status was reviewed for the information of all concerned.	Info
7.3	Ontario Hydro inspection has been completed. Acceptance notification will be included in the final documentation.	TCEGL
7.4	Non CSA approved equipment (e.g. Athena controllers) will require Ontario Hydro special inspection. This will be done by EMR.	EMR
7.5	Selector switches on order are expected the week of April 25. EMR will install the switches.	TCEGL/ EMR
7.6	Continuity testing has been completed and accepted by EMR. There are no outstanding deficiencies on the contract work.	Info
7.7	EMR requested final drawing documentation in disk format (Autocad) in addition to hard copies.	TCEG
7.8	Rear panel doors have been left off at the request of EMR to facilitate pilot plant start-up.	Info
7.9	Floor penetrations have been left unsealed at the request of EMR.	Info

ACTION BY

7.10 The Kennedy Electric job box and site trailer will be removed not later than the week of May 2. — TCEGL

7.11 EMR have acknowledged receipt of keys for panel door locks. — Info

7.12 It was agreed that documentation for changes to Monenco loop sheets has been provided toEMR and that since the changes are minimal, no further action is required by the contractor. — Info

B.R. Emery, P.Eng.
BRE/mlm

cc: All present
KEL - RZ

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: DISTRIBUTION

FROM / DE: J.D. Chase
Primary Upgrading Section
CANMET/ERL/EMR

SECURITY - CLASSIFICATION - DE SÉCURITÉ:

OUR FILE/NOTRE RÉFÉRENCE:

YOUR FILE/VOTRE RÉFÉRENCE:

DATE: August 27, 1987

SUBJECT / OBJET: **Minutes (Preliminary) of Initial (Kick-off) Meeting Between Cambrian Engineering, and EMR for Panel and Instrumentation Installation Contract for EMR's Coprocessing Pilot Plant**

The meeting was held on August 25, 1987 at the Energy Research Laboratory at EMR's Bells Corners Complex. The following were present:

Frank S. Tung - Project Leader from Cambrian Engineering
R.B. (Bob) Sine - Manager Automated Systems, Kennedy Electric Ltd. (Sub contractor to Cambrian)
J.D. Chase - Project Leader PP3 Construction, CANMET, EMR
C.A. McNabb - Instrumentation Technologist, CANMET, EMR

(A) Timing:

Cambrian felt that the contract could be completed (in FY 86/87) by March 31, 1988, provided significant delays caused by (a) operation of PP1 pilot plant next to PP3 site, or (b) a possible catch-up period referred to in contract (for EMR to complete mechanical construction) did not materialize.

With respect to above potential delays to contract completion, caused by EMR, the latter indicated that a run on PP1 will begin on September 1 and continue until about September 20. EMR is unable to predict when future PP1 runs will be made since these depend on developments at the CANMET demo plant.) A reasonable guess at this time is that one additional 3 week duration run on PP1 will be done sometime during October, November or December, 1987.

EMR indicated that they had some preference to completing instrumentation in the slurry area first since this would enable EMR to test out uncertainties associated with slurry preparation and pumping aspects. R. Sine said that there could be advantages to working on the slurry area only when work was forced to stop in the main PP3 process area. EMR will reserve judgement on this suggestion.

(B) Work Allowed in PP3 Bay While PP1 Operating:

Some discussion took place in an attempt to define specific work which can be done in main PP3 area while pilot plant PP1 is in operation. EMR said they would get input on this and report back to Cambrian. In subsequent discussion at EMR, it has now been established that work can proceed provided an open flame, arc, or sparks are not produced. Thus conduits can be installed and roughly put in place by ordinary wire, during PP1 operation. Then drilling to permanently attached conduits can be done later when PP1 is down. The conduit threading can be carried out in mezzanine level on the non-process side of the steel wall.

.../2

(C) Items on Agenda By EMR (C.A. McNabb's List):

Items from C.A. McNabb's (CAM) list (see Appendix) were discussed, and are referred to here under CAM's numbering system.

1. Cabinet C was shortened by 21 in. for a combined panel width from 2 drawings of 187 inches.

2. The Cambrian and Kennedy Electric people took items with them on August 25, which were missed in the instrument pick-up on August 13. Specifically, these were analog output devices for Toledo Weigh Scales.

3. The SCR or D1 and D2 panels were located during visit to Bldg. #4. Cabinet dimensions are: 18" D, 54" W and 84" H.

4. & 8.

   CAM provided some revised loop diagrams which contain terminal numbers for loops associated with pressure transducer cabinet and one flow controller.

5. CAM expects to have all points tagged by end of September.

6. The status of mechanical construction was discussed and EMR indicated that we feel it unlikely to need a pause in the contract to enable us to complete our work.

7. CAM had run off an updated instrument list and this will be sent to Cambrian within a few days of kick-off meeting.

9. Equipment layout drawings (D size) were requested by Cambrian and EMR will process this request.

(D) Signed Statement on Receipt of Instruments by Cambrian:

EMR said they needed a signed letter from Cambrian stating that 47 boxes of EMR's instrument inventory was received, plus the detailed inventory list.

(E) Requests by Cambrian of Information Needed from EMR:

(1) EMR to supply detailed drawings of reactors (showing dimensions, thermocouple ports etc.

(2) EMR to supply explanation of identification numbering system for parts of process (areas 1-13 on P&ID's)

(3) EMR indicated that thermocouple connections beyond the jacks which extends about 6 in. out of insulation on vessel will be Cambrian's responsibility. EMR will install actual thermocouples.

.../3

(4) EMR to send Cambrian equipment layout drawings and Bldg. #4 architectural drawings soon (about September 1). (Ideally, these should be sepia or vellum and EMR would have these reproduced. Cambrian would prefer sepia of all loop drawings, but EMR will enquire on reproduction cost before responding to this request.

(5) EMR will attempt to provide enough information on - (a) CAD system at EMR, and (b) the CAD system used by MONENCO to enable Cambrian to update our loop diagrams to "as-built" status. (Item (a) could give EMR facility of updating Cambrian CAD - produced documentation in futura.

(F) Approach:

(1) Cambiran and Kennedy Electric will use Custom Control Panels to fabricate panels since Kennedy's Panel shop is booked.

(2) Cambrian will bring a trailor on site when they begin the instrument installation task. The location for trailer has already been determined. Cambrian will use building, and equipment layout drawings provided immediately by EMR, to sketch in routing for instrument conduits. These sketches will be firmed up during a visit to this site by Cambrian personnel within a month or so.

(4) Correspondence will be by telecopier or FAX between Cambrian and EMR. The newly installed unit at ERL will be used (FAX 613-995-9584). For lengthy correspondence or documents of significant size, Courier service will be used. Correspondence from Cambrian to EMR will be sent to J.D. Chase.

(G) Other

(1) C.A. McNabb will produce a drawing showing location of all panels plus RPU and pressure transducer cabinet.. or panel for PP3 situated in the operating aisle. This scaled block or schematic drawing will be sent to Cambrian.

(2) Cambrian requested two more sets of loop and Panel drawings. EMR hasl asked DS&S to expedite their return from unsuccessful bidders.

(3) Cambrian is to arrange for meeting at Custom Control Panel's shop between the latter and EMR electricians. Up to 2 such visits are requested. Visits to take place at about 50% and 100% of panel completion.

DISTRIBUTION

C.A. McNabb	EMR
L. Mysak	EMR
D.J. Patmore	EMR
J.M. Denis	EMR
R.B. Logie	EMR
F. Tung	Cambrian Engineering Group, Mississauga
R.B. Sine	Kennedy Electric Ltd., Mississauga

JDC/jg

APPENDIX I

To Be Discussed at the Meeting of August 25th

1. The shortening of cabinet C to make room for the pressure transducer cabinet.

2. The shipping of the analog output units for the HE and LE drums.

3. The location of the Phase Amp cabinets.

4. The designated terminal numbers for the pressure transducer cabinet.

5. Tagging numbers for the field componets.

6. The stage of construction.

7. Information from the instrument list.

8. New terminal numbers for the loop diagram.

9. Layout drawing of reactor vessels, recycle gas pumps, slurry area and operating aisle.

November 25, 1987

To Jack Chase

From Charles McNabb
Gerry Kluke

Subject: Minutes of meeting with Cambrian Engineering Group.

November 17, 1987:
Left Ottawa 09:45 for Toronto via government vehicle.
Arrived at Cambrian Engineering Group 14:45

Attendence:

Charles McNabb;	EMR, CANMET, ERL
Gerry Kluke;	EMR, CANMET, TSD
Brian R. Emery	Cambrian Engineering Group, Vice-President, Eastern Region
Jimmy Looi	Cambrian Engineering Group
Remis Zabiela	Kennedy Electric Limited

Agenda:
1) Review of work in progress.
2) Travel to Custom Control Panels Ltd.
3) Inspection of work in progress.
4) Meeting November 18, 1987, 09:00, Cambrian Eng. Group
5) Return to Custom Control Panels Ltd. to answer further questions and take photographs.

Initially a discussion on the general progress of the project took place. Cambrian hoped that delivery of the Instrumentation Panels could be made before Christmas and that the construction trailer could be on site to store the panels until they were required. Cambrian inquired to the progress of checking the A2 CUSCO mimic layout drawings. Mr. McNabb indicated that he had received the drawings the previous day and he had them with him and they would be checked by 09:00 on the 18th of November. Cambrian inquired to the progress of tagging of the field instruments. Mr. McNabb indicated that the tagging process was slow due to the opertion of PP1. Mr. McNabb indicated that CANMET had only one copy of the Panel and Loop Drawings and if there were any spare copies to please send them a second set. It was agreed to proceed to Custom Control Panel Ltd. and meet again 09:00 at Cambrian Engineering Group for detailed discussions on the Instrumentation Panels.

Arrived at Custom Contol Panels 15:45 and met with a Mr. Anil K. Bhalla, P. Eng. There followed a general discussion concerning the panels construction.

Panel A2 would require a 30 amp 120 volt circuit.

Panels D1 & D2 have a problem in the power supply recommended by Monenco. A preliminary discussion decided that they required a back mounted Square D 42 circuit breaker panel. Mr. Bhalla requested that all changes be submitted as soon as possible. A discussion on the delivery dates followed. Mr. Bhalla

indicated that panels A1 & A2 would be returned to his shop on November 19th. from the paint shop. A delivery date of December 14th for the panels would be impossible to meet. Panel S would be completed in 10 days time and panels D1, D2, A1, A2 and C would be ready for 50% inspection by December 15th, 1987. Because of the Christmas break coming up the panels would not be completed until sometime in January.

It was observed that Panel S would not be able to go through the door into the control panel room in the slurry area and that one wall of the control panel portable room would have to be removed then replaced after the panel S was installed.

The meeting was adjourned until the following day November 18th, 1987.

November 18, 1987
Cambrian Engineering Group Ltd.
Attendence: Charles McNabb, Gerry Kluke, Brian Emery, Jimmey Looi and Remis Zabiela.

Mr. McNabb provided Cambrian with the approved CUSCO drawings for panel A2.

Mr. Zabiela is working on all of the wiring details of the instrumentation cabinets and had almost all of the questions concerning the wiring of the cabinets and the loop diagrams. Most of the questions concerned the power supply and Monenco's failure to understand the power being provided to the cabinets and the amount of power that would be required. The questioning proceded by cabinet.

Cabinets D1 and D2: Phase Amp Cabinets

A sketch of the proposed power supply for cabinets D1 & D2 was provided as indication of what was to be done. The sketch showed a main circuit breaker inside D1 & D2 with 3 phase 208 V power supplied. Gerry Kluke suggesed small changes to the sketch involving the power supply wiring. The changes would be made and the sketch would go to Custom Control Panels so that the work could proceed.

Control Panel C: Heater Control Panel

Panel C is to be changed to a three phase input and the wire size decreased to a 30 amp service.

It was noted that Panel C showed no fuses therfore it was decided that:

1) One fuse per 10 Barber Coleman controllers.
2) One fuse for the Athena controllers.
3) One fuse per heater
4) Athenas require three amps each.
5) Seperation of service distribution using black.
6) Grouping of wire to neutral white.
7) Number eight wire to be used.
8) A 30 amp service for for Cabinet C.
9) To use a number eight wire.

NOTE: The output from the Barber Coleman's is a signal line to the Phase Amps in Cabinets D1 and D2 which have seperate fusing

per output to the heaters.
The output from the Athena's is power to the heaters and require one fuse per heater.

It was noted that all changes would reflect an increase in price. The price changes would be available in a few days.
A general agreement was made one wire sizes.
1) Number 14 for power.
2) Number 3 for main input.

Panel A1: Control Instruments and Small Mimic
It was noted that all panels show no power distribution. If a power distribution drawing was requested by CANMET then one could be provided at extra cost. It would not be necessary for the construction of the panels but would be useful to CANMET for reference in the future.
1) The 60 amp service shown was allright.
2) The recepticles would require a 15 amp, 208, single phase, 3 wire, 2 pole service.
3) The solenoids would be grouped on one fuse.
4) One fuse for the power bar.
5) One fuse for the remainder of the direct wired instruments.
6) One fuse for 24 volt DC power supply.
7) One fuse for 10 volt DC power supply.
8) One fuse for DC drive
9) 208 power supply for DC drive.
10) Main power supply 30 amps
11) Other power supply 15 amps

Panel A2: Large Mimic
1) Change control power line from black to red.
2) Each solenoid individually fused.
3) 110 V, 30 amp service for solenoids.
4) Individual breaker for recepticles.

Cabinets D1 and D2: Phase amp cabinets
1) Three phase 208 V, 3 wire
2) Use a 42 circuit breaker Square D
3) Current 100 anps per cabinet
4) Main breaker 100 amps
5) One 15 amp 2 pole breaker for recepticles
6) One 15 amp single pole breaker for lights and fan.
7) Current signal input black required.
8) Current terminal strips for heaters out.

Panel S: Slurry room cabinet
1) One three phase feed for whole panel
2) Slurry system amperage required.
3) No fusing show for the heaters
4) 01-TY4004, 5, 6, 15, 16 & 17 the feed tank heaters show 115 volts; check to see if not 208 V.
5) 01-TY4024 & 25 line heaters shown as 208 V check to see if not 115 V.

6) Individual fuses per heater are required.
7) Controllers group fused. One for feed tanks one for remainder.
8) Valve actuators and heaters on seperate circuits.

General Comments:

1) Cable numbers on SCR heater cables to be the same as the heater numbers.
2) All wiring to RPU has no numbers and Cambrian to develop their own numbering system which would require CANMET to update its loop drawings.
3) 03-T-4017 has no SCR for heater. CANMET to supply SCR for panel D2 slot 15.
4) 01-TY4009 not shown on juction box to be added.
5) Stratol mixers located on slurry room south wall lower level. Cambrian suggested locating in control room with Alan Bradley dust proof pots lower level.

The meeting broke for lunch at 13:30 and reconvened at Custom Control Panels.

At Custom Control Panels pictures were taken of all the available control cabinets (D1, D2, S and A2). Gerry went over the proposed power supply changes to cabinets S, D1 & D2. The heat sinks for the solid-state relays would not fit in the space provided, and the mounting of the solid-state relays directly on the panel was given approval since it was the pratice now used for PP1 and PP2. It was noted that iron constatine terminal blocks were not specified for the thermocouples. They enquired if wiring directly to the instruments was allright? It was pointed out that the thermocouples make a split at the terminal blocks therefore the termal blocks were necessary. Initially CANMET would send Custom Controls 100 iron constatine terminal blocks. Further explanations as to the use of such equipement as the Digilink was given to the men constructing the control panels to given them a better idea of what they were working on. The meeting at Custom Control Panels Ltd concluded at 15:45.
Arrived back in Ottawa at 20:00.

Prepared by: Charles McNabb
with Gerry Kluke

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: Distribution

FROM / DE: J.D. Chase
Primary Upgrading Section
ERL/CANMET/EMR

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE/NOTRE RÉFÉRENCE
YOUR FILE/VOTRE RÉFÉRENCE: 504102-01
DATE: January 20, 1988

SUBJECT / OBJET

Trip Report/Minutes of Meeting Between EMR and Cambrian Engineering and Subcontractors re PP3 Instrumentation (DSS-14SQ-23440-7-9006)

I. Introduction

On Jan. 15, 1988, C.A. McNabb (C.A.M.) and the writer (J.D.C.) went to Mississauga to discuss the coprocessing pilot plant instrumentation contract (DSS 14SQ-23440-7-9006) and to check on progress at the panel fabricators. In the morning we met at Cambrian's offices at 2200 Argentia Road with Brian Emery (B.E.), project manager and Vice President of Cambrian and Jimmy Looi, his assistant, and Remis Zabiela from Kennedy Electric (KEL).

II. General

We discussed the conduit specifications they sent us. EMR requested 2 copies of enlargements of some drawings since parts of the B size were illegible. C.A. McNabb responded to the Camprian telecopier message of Jan. 8. With respect to conduit drawings, "as built" drawings will be provided since many of the conduits will be "field run" (without detailed drawings). Remis of Kennedy Electric asked if 10% spare wires in a conduit were enough. EMR indicated that this was satisfactory. It was decided that wiring of pressure transducers would be EMR responsibility except for wiring between our pressure transducer cabinet and other panels.

B.E. asked if a sales tax rebate may be available for purchase. J.D.C. answered that he should check with M. Renaud of DSS on this issue. J.D.C. asked whether there was a parts list available from Kennedy Electric. B.E. said that this was just an internal document.

.../2

III. Slippage in Completion Dates for Contract

J.D.C. said that progress and milestones on this contract were 4 to 6 weeks behind, and he stressed that we cannot count on money for this contract being available in the next fiscal year beginning April 1. J.D.C. mentioned that payment this FY for work done next FY was not an option, since EMR must only pay after work is completed. J.D.C. requested a variance report at end of each milestone and payment, re realistic completion dates.

B.E. said he is taking steps to correct the slippage by considering an increase to 4 electricians available with Neil of Kennedy Electric (KEL) on site at EMR. The KEL trailer has been at EMR since about Jan. 7, 1988.

Three panels: S, D1 and D2 will be sent to EMR on about Jan. 21. However, panels A1, A2 and C will not be ready for shipment until Feb. 15. J.D.C. said that this is a major delay, consequently it is quite possible that not all work will be complete by March 31. (Documentation definitely after March 31.) A major cause of the delay is that the mimic panel is late on arrival. To assist KEL on parts availability, 25 strips of thermocouple-terminal blocks will have to be sent from EMR. CAM will respond immediately to this request (Item #5 of Cambrian FAX of Jan. 8).

IV. Shipping of Panels with Instruments

J.D.C. expressed concern that if this was left to a regular carrier they might be damaged, and J.D.C. wondered if Cambrian or KEL might consider renting a truck and their own personnel accompany the panels. J.D.C. also said that unloading panels and moving them to location in Bldg 4 operating aisle is not EMR's responsibilty. Remis of KEL mentioned that a shock meter will be attached to each crated panel on shipment to indicate rough handling.

V. Site Supervision is Cambrian's Responsibilty

EMR referred to the Contract (Appendix II) where it indicated that site supervision is Cambrian's and not EMR's responsibility. J.D.C. mentioned that there was $4,500 in contract for travel expenses, and that subsequent progress meetings will be held at EMR at two week intervals (at minimum). The next meeting will be held about Jan. 27, but this to be confirmed later.

VI. Meeting at Custom Control Panels (CCP), In Afternoon

The person whom we spoke with here was Anil K. Bhalla.

The main wiring problems remaining were discussed, and they were the following:

1. Location of Toledo scales.
2. Wiring of Toledo scales to Honeywell PLC.
3. Wiring from alarm outputs to horn.
4. Apparent failure of some Athena Temperature controllers. (Although only 1 is definitely faulty).

.../3

5. Connectors for the output of Toledo scales.
6. The millivolt to milliamp transducers to be shipped to Custom Control Panels.
7. J-type terminal blocks to be shipped to Custom Central Panels from EMR.

J.F. Kelly, EMR
M. Ikura
J.M. Denis
D.J. Patmore
C.A. McNabb
B. Emery - Cambrian Engineering Group
M. Renaud - DSS

JC/jt

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: DISTRIBUTION

FROM / DE: J.D. Chase
Project Leader PP3, Construction)
SFRL/ERL/EMR

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE/NOTRE RÉFÉRENCE: Project 504102-01
YOUR FILE/VOTRE RÉFÉRENCE:
DATE: February 5, 1988

SUBJECT / OBJET: **Minutes of Meeting Between Cambrian Engineering/ Kennedy Electic Ltd. and EMR**

The subject meeting took place on Monday, February 1, 1988 at EMR's Bells Corners Complex in order to monitor and facilitate progress on Contract (14SQ-23440-7-9006) involving instrumentation of the copercessing pilot plant.

Present at the meeting was Brian Emergy (BA) project Manager from Cambrian, Remis Zabiela (RZ) from Kennedy Electric in Mississauga and Neil Ouellette (NO) who is the Kennedy Electric electrician supervisor on site. C.A. McNabb (CAM) and the writer (JDC) from EMR, took part in the meeting.

The main area of concern is the slippage of 4 to 6 weeks between initial projected target dates and actual present status of the instrumentation.

The S and D panels arrived on site a few days ago and have been put in place. The date for both A panels and C panel to be ready at the panel fabricators is February 15. The writer indicated and B. Emergy agreed that a very strong case can be made for the remaining panels to come to EMR in two rather than one shipment. By such a plan the electricions can be hired to immediately make panel installation, as there is no logic to keeping a panel in Mississauga while one waits for delivery of a couple items.

Since Custom Control panels trust the Carrier, the writer will no longer insist that Kennedy personnel accompany the shipment of panels. However, EMR wants shock meters or shock indicators to be placed on A_1, A_2 and C panels during shipment in order to monitor the carrier.

Cambrian is to arrange for Ontario Hydro inspection for compliance to standards. EMR wants this inspection, or at least one of these inspections to take place between March 15 and March 31, 1988.

RZ of Kennedy Electric Ltd. (KEL) asked Neil when the electricians could complete wiring to the following areas: (a) slurry area and (b) main process area. Neil answered March 15 for (b) and February 29 for (a). Neil and KEL were instructed to hire enough electricians to complete the work by March 31.

.../2

The writer asked CAM how near EMR was to installing all heaters, and control and other thermocouples to enable KEL to do the wiring of slurry area. CAM answered that this area was 95% ready. The writer is asking Al Kuiper (AK) the construction team leader for this area, to make the above his top priority.

Starting February 8th , N.O will be hiring at least 4 electricians. At least 2 for the slurry area and 2 for the process area. B. E. of Cambrian indicated that the use of increased manpower such as this is how Cambrian intends to complete their contract on schedule.

EMR indicated that a small problem area has come to light regarding the perceived need of an extra electrical heater on the high pressure, high temperature separator. At the meeting on February 1 EMR and Cambrian agreed that this extra work should be documented and flagged as an increased scope item. However, internal discussions at EMR on February 4th have indicated that the original number of heaters may well be sufficient after all. The relocation of a solenoid from the additive line to one of the coal delivery chutes is one aspect of a slight increase in scope.

The writer indicated that he was told that a PP1 run is likely to commence on or about March 15th, so work on this contract should plan for this eventuality. NO said that the suggested approach would be to make terminations at the plant side rather than panel side of conduits while PP1 is not running. Then when PP1 is in operation the panel side terminations could be made.

The writer mentioned that one responsibility of Cambrian, as indicated in the contract, was to bring to EMR's attention, areas where Cambrian may shortly be held up by EMR. The main priority of EMR is to do all they can to insure that we do not cause delay of this contract.

The next EMR-Cambrian meeting will take place at EMR on February 16th.

Gerry Kluke was instructed to purchase terminal board connections to replace those that CAM sent to Custom Control Panels (CCP) as a result of our January 15th meeting at CCP.

DISTRIBUTION:

→ Brian Emery	Cambrian Engineering
D.J. Patmore	EMR
R.B. Logie	"
L. Mysak	"
C.A. McNabb	"
J.M. Denis	"

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: DISTRIBUTION

FROM / DE: J.D. Chase
(Project Leader PP3 Construction)
SFRL/ERL/EMR

SECURITY - CLASSIFICATION - DE SÉCURITÉ:

OUR FILE/NOTRE RÉFÉRENCE: Project 504102

YOUR FILE/VOTRE RÉFÉRENCE: 035.2

DATE: February 22, 1988

SUBJECT / OBJET: **Minutes of Meeting between Cambrian Engineering/Kennedy Electric Ltd. and EMR**

The subject meeting took place on Wednesday February 17, 1988 at EMR's Bells Corners Complex in order to monitor and facilitate progress on Contract 14SQ-23440-7-9006 involving instrumentation of the coprocessing pilot plant.

Present at the meeting was Brian Emery (BE) Project Manager from Cambrian and Jimmy Lori; Norman Mihan (NM) Managing Director of Kennedy Electric Ltd. (KEL) and Neil Ouellette electrician supervisor on site. C.A. McNabb, R.B. Logie and the writer from EMR were present.

NM explained that one reason electrical installation was behind schedule was the lack of inventory of explosion proof conduit fittings in Canada. This material was finally procured in New York State. One shipment arrived on Feb. 17 and the final shipment should arrive by Feb. 22. The two sections of C panels (temperature controller panel) also arrived on Feb. 17.

The final panels to arrive will be A1 on Feb. 22 and A2 on Feb. 26 or 29. JDC wants shock meters attached to the delicate A panels on delivery.

JDC asked how Cambrian intends to make-up for slippage in tasks completed at designated dates. The answer was to hire more electricians such that by Feb. 18 there would be 4 KEL electricians on site. N.O. said that completion dates for slurry area and process area are still Feb. 29 and March 15 respectively.

One option for making up lost time is to use extended hours. In such a case an EMR employee must be in the building and a pass would have to be issued by the director of ERL. The writer could serve as the EMR employee for some days, but wants personnel in R. Logie's section for coverage on other days.

JDC and N.O. agreed that March 15 is the best date for Ontario Hydro inspection. JDC indicated that this must be done between March 15 and March 31.

N.O. asked about the terminal boards for the computer connection. JDC indicated that a design decision must be made by D.J. Patmore, T. de Bruijn, JDC and CAM at a meeting on Feb. 23 in this regard.

..../2

CAM said there were only four more points to be tagged in the slurry area. Tagging is required on both tubular reactors, but tags are made up so this should not hold up KEL.

KEL reminded EMR that power to all panels is EMR's responsibility as also is power delivery to four motors including two in the slurry area.

JDC said that N.O. is unlikely to be able to handle both circuit checks as well as supervise four electricians on an accelerated work schedule. N.M. answered that R. Zabiela from KEL could be here to handle circuit checks with CAM after the first week in March.

JDC expects Cambrian to have one of their employees on site for a significant portion of the time up to target completion date of March 31, as stated in contract. (Cambrian has budgeted $4,534 for travel in their bid of this contract).

JDC indicated we should strive to complete the contract by March 31. However, due to shippage (a) preparation of "as run" conduit routing diagrams, and perhaps (b) completion of Instrument Inspection and debriefing (Milestone number 8) may well take place in April. EMR's top priority is to avoid holding up Cambrian and KEL.

The next meeting between Cambrian and EMR will be held at EMR on Tuesday March 1, and will commence about 10:00 a.m.

DISTRIBUTION:

D.J. Patmore
J.M. Denis
R.R. Logie
L. Mysak
C.A. McNabb
B. Emergy (Cambrian)

JDC/wll

Transmit FX -3 Mar 7 to KEL

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: DISTRIBUTION

FROM / DE: J.D. Chase
Project Leader PP3, Construction)
SFRL/ERL/EMR

SECURITY - CLASSIFICATION - DE SÉCURITÉ:

OUR FILE/NOTRE RÉFÉRENCE: Project 504102

YOUR FILE/VOTRE RÉFÉRENCE:

DATE: March 4, 1988

SUBJECT / OBJET: **Minutes of Meeting Between Cambrian Engineering/ Kennedy Electric Ltd. and EMR**

The subject meeting took place on March 1, 1988 at EMR's Bells Corners Complex in order to monitor and facilitate work on Contract 14SQ-23440-7-9006 involving instrumentation of the coprocessing pilot plant.

Present at the meeting were Brian Emergy (BE) P.Eng., Cambrian's project Manager and Jimmy Looi, Neil Quellette (NO) the electrician supervisor on site for Kennedy Electric Ltd. (KEL). Present from EMR were: C.A. McNabb (CAM), R.B. Logie, (RBL), Luigi Mysak (LM) and the writer (JDC).

Initially, we went over the minutes of the February 17th progress review meeting. The main issue was slippage in completion date. BE said that with the accelerated progress due to more electricians (5 now on site) completion of contract by end of March is now achievable. This includes inspection. CAM who will be the EMR person during inspection, generally agreed. Remis Zabiela (RZ) from KEL will be involved in checking out circuits and will be on site beginning March 9.

In order to wire in the computer RPU to record sensors, we need J-Type connectors with 20 points per strip. Thirty of these strips at a cost of $52 each will be required. JDC said that our normal supplier would have a delivery of 2 weeks after receipt of order. BE and JDC agreed that KEL should place the order and we can sort out the finances later. The provision of this material is EMR's responsibility.

All instrument panels are now on site. Ontario Hydro has not yet been contacted for their mid March inspection. JDC wants these arrangements to be made immediately. (See Minutes of last meeting.) A preliminary inspection including panels, conformity of conduit to process area classification, and CSA approval of equipment, would be done during the March 15 visit.

A problem has come up concerning wiring of the switches which activate the electric ball valves in slurry area. In a letter to JDC, B.E. indicated that he felt there was an error in logic in the loop diagrams provided by MONENCO. CAM believed that the loop diagrams were O.K. To resolve this problem, CAM, N.O. and RZ could put forward their opinions via telecopier, if necessary. A practical solution said NO, might be to increase the number of wires to the switches from 5 to 6 by running another wire.

JDC suggested that extended hours might be an option to meet deadlines. BE indicated that their preference was to hire more electricians rather than to work overtime.

CAM indicated that tagging of instrument points is complete for slurry area. This work is now continuing on the reactors.

BE provided JDC with invoices to cover milestones related to (1) panel fabrication and delivery and (2) conduit installation between panels and field junction boxes. JDC will hand deliver these where it is possible.

JDC referred to the Contract which stated that the contractor is to have someone on site to supervise and oversee the subcontractor's work and progress. One task of such a person would be to expedite materials needed by the subcontractor. BE answered that expediting could be done just as well by Cambrian and KEL from Mississauga as on site.

The date of the next progress review meeting will be decided upon later (around March 8, 1988).

DISTRIBUTION:

J.M. Denis
D.J. Patmore
C.A. McNabb
R.B. Logie
L. Mysak
B. Emery (Cambrian) BY FAX
J.F. Kelly
M. Ikura

JDC/jg

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

D35-6 BRE JL o/c

TO / A: DISTRIBUTION

FROM / DE: J.D. Chase
Project Leader PP3, Construction)
SFRL/ERL/EMR

SECURITY - CLASSIFICATION - DE SÉCURITÉ	
OUR FILE/NOTRE RÉFÉRENCE	Project 504102
YOUR FILE/VOTRE RÉFÉRENCE	
DATE	May 2, 1988

SUBJECT / OBJET: **Status Report and Minutes of Cambrian - EMR Progress Meeting for Instrumentation Installation for PP3 Pilot Plant**

A meeting was held at Bells Corners on April 22nd, 1988 to review progress and facilitate completion of Contract No. 14SQ.23440-7-9006 and the following were present.

Brian Emery - Project Manager for Contract (from Cambrian)
Norman Mihan - Managing Director of Kennedy Electric
R.B. Logie - EMR
L. Mysak - EMR
G. Kluke - Tech Service
C.A. McNabb - EMR
J.D. Chase - EMR

Most of the work on project was virtually complete in 87/88 FY prior to March 30th. Nonetheless, there was a reduced work crew from Kennedy Electric on site prior to this meeting to complete some smaller items.

JDC indicated that he had signed the invoice for claim No. 5 involving power delivery to panels. JDC said that he had delt with the proposed change order of Cambrians which is taking the form of a second amendment to the contract. Most but not all of Cambrian's items (6 out of 7) were being incorporated into this amendment. The item which the S.A. felt should not be included involved a reorder of 10 selector switches for the slurry area and involved about $1700. This led to considerable discussion and the writer and BE. agreed to disagree, and to defer a decision on this matter. BE indicated that 10 Allen Bradley selector switches had been ordered and replacement of the earlier switches by this brand would achieve a saving of about $1000. Since these switches would be late in arriving, they will be installed by EMR (TSD).

Bob Dunk, the Ontario Hydro inspector, was on-site during week of April 18th, to complete his inspection of the Contractor's work. Documents from Ontario Hydro will be included in Cambrian's final report.

CAM was the EMR representative involved in the point-to-point continuity inspection for the instrumentation. A few errors such as the following were found. Three thermocouples (TE-4012, TE 4013 and TE-4014) were connected to terminal block TB6 in panel A1 instead of TB6 in panel C. Also, resistors were missing from the phase Amps in panel D. The above and a few other errors were corrected prior to the April 22nd meeting. CAM mentioned that he was impressed with the very small percentage of errors by the Contractor that was found from the continuity inspection.

.../2

The issue of open spaces in walls and floor around the outside of conduit was discussed. It was decided that these holes in the floor would remain open since this would allow dissipation of hydrogen upward if there was a hydrogen leak. In contrast , these openings in walls will be blocked when there is a change of hazard zone. (For example, through the steel wall which separates the main process area from the operating aisle). Seals were put (poured) in all conduit which passes through changes in hazard zones.

For the present, the steel "doors" in the back of instrument panels will remain off to provide access. G. Kluke of TSD agreed with the approach of locking all keys to panel doors in the key box in Bldg. 4. Power lines to the brakers to the various panels were left disconnected at present for safety reasons. A simple connection can easily be made by a TSD electrician when we want power to the panels.

Documentation of drawings to the "as-built" status is the final task to be completed in the contract. The conduit layout drawings produced under this contract will be updated by the CAD unit. A copy of a disc containing this information will be given to EMR. (The Kennedy Electric machine is AUTO CAD RELEASE-LINE). Since there is less than 10 changes needed to the instrument loop drawings provided by MONENCO, the originals will simply be updated using red pencil. EMR's perference is that the updating to the "as-build" status of MONENCO's panel wiring and panel layout drawings be done by CAD (Computer-aided-design). Cambrians preference is to manually mark with red pencil the updated "as-built" status on the original panel wiring and layout drawings provided by MONENCO. (The details of the documentation update are not specified in the contract.)

Three copies of the final report including the documentation will be targeted for completion along with the debriefing session in early May, 1988.

Kennedy Electric will remove their trailer from ERL in early May.

DISTRIBUTION:

R.B. Logie
L. Mysak
D.J. Patmore
→B. Emery (Cambrian)
J.M. Denis
C.A. McNabb
G. Kluke

JDC/jg

April 21, 1988

CONTINUITY TESTING

Introduction:

The continuity testing of the wiring done by Kennedy Electric was a test of the field wiring completed in the different areas of Pilot Plant PP3 located in building four. This test was not a check of the internal wiring of the instrument cabinets done by Custom Control Panels in Toronto. This test was not a functionality test of the loops but a test that the wiring from instrument cabinet terminal blocks to the field instruments was correct.

Method of Testing:

With field instruments such as heaters a meter was placed between the Load line and Ground in the instrument cabinet and in the field the load line was grounded then not grounded. This gave a zero resistance when grounded and a infinite resistance when not grounded. The grounding was repeated a minimum of two times.

With thermocouples the meter was placed across the positive and negative terminals at the instrument cabinet and in the field the appropriate thermocouple was connected and disconnected. This caused a zero and infinite resistance respectively. The process was repeated a minimum of two times per thermoucouople.

Results:

Panel S: The ZSL [valve position indicator] wires were connected to TB6 instead of TB11. The problem has been corrected.

Panel A1: 01-TE-2002, 01-TE-2013 and 03-TE-2138 were to be attached to TB6 but TB6 thermocouple terminal did not exist therefore they will be connected to TB15 13-14, 15-16 and 17-18 respectively. Connections between Panel A1 and S have to be checked out. The speed controllers and level controllers have yet to be checked out. The weight scales are to be completed by Toledo scales as requested by Al Kuiper.

As of the date of this document the work indicated above has been completed.

Panel A2: Panel A2 checked out with no problems.

Panel B: Only two pressure transducer wires were run by Kennedy Electric to panel B. The wiring between Panel B and the computer RPU is still to be completed. The work was not done by Kennedy Electric because the terminal block numbers was not provided to them on time.

Panel C: The wiring between Panel C and the field, Panel C and Panel A1 and Panel C and the RPU was checked out. The only problem was that 03-TE-4012, 03-TE-4013 and 03-TE-4014 were connected to TB6 in panel A1 instead of TB6 in panel C.

As of the date of this document the above work has been

completed.

Panel D: The connections between Panel D and Panel C and Panel D and the field checked out OK. The Phase Amps were missing the resistors but were installed by Kennedy Electric.

Other: The thermocouples to the CSTR were checked out to the terminal box on the second floor. The hand switches and heaters were checked out to see that the wires were run.

Completion of work: The continuity testing should be completed with another half day of work which is scheduled for the 19th of April.

As of the date of this document all of the continuity testing has been completed and all corrections have been made.

Prepared by

Charles McNabb

PACKING SLIP

KENNEDY ELECTRIC LIMITED
201 WILKINSON ROAD
BRAMPTON, ONTARIO
L6T 4M2
TELEPHONE (416) 450-1306
TELEFAX (416) 450-3869

DATE: March 31 1988 JOB #: K-8990

TO: Energy, Mines & Resources Project: PP3
Building 4
Bells Corners Complex
Ottawa, Ontario.

ATTN: Mr. C. Mcnabb

SENT BY: Custom Control Panels
Mississauga, Ontario.

ITEM#	DESCRIPTION	QUANTITY
1	Thermocouple terminal strips	2
2	Heat sinks for SCR heat controllers	47
3	Cables #KA572946 C/W multipin connectors	2
4	Toledo analog output modules #KB572,851	2
5	ATC timer #U8530A (item #16)	1
6	Resistors (item #14)	lot
7	Controller (item #42)	1
8	Controller Toledo Scale (item #47)	1
9	Balmar contactors #LZF1-2425	3

DATE: March 31 1988 RECEIVED BY: C. Mcnabb

the cambrian group

2200 ARGENTIA ROAD
MISSISSAUGA, ONTARIO
CANADA L5N 2K7

DRAWING TRANSMITTAL

TO CANMET, Energy Mines & Resources Canada
c/o 555 Booth Street
Ottawa, Ontario
K1A 0G1

DATE May 30, 1988

PROJECT NO. D35.6

DESCRIPTION

ATTENTION Dr. J.D. Chase
Synthetic Fuels Research Laboratory

ENCLOSED ARE SEPIAS / PRINTS **OF THE FOLLOWING DRAWINGS:**

QTY.	DRAWING NO.	REV. NO.	ISSUE STATUS: PROGRESS PRINT	PRELIMINARY	FOR REFERENCE ONLY FOR FILE	FOR APPROVAL	APPROVED FOR CONSTRUCTION	REVISED APPROVED FOR CONSTRUCTION	APPROVED AS NOTED	REMARKS
3										Sets 'Monenco'
										Documentation consisting
										of 2 binders each:
										i) Instrument Panel Dwgs
										ii) Instrument Loop
										Diagrams
										Returned as required
										by Contract

☐ Please Sign Duplicate Copy of Transmittal and Return

TO _____

RECEIVED BY _____

DATE RECEIVED

CONTRACTOR	THE CAMBRIAN ENGINEERING GROUP LIMITED 2200 ARGENTIA ROAD MISSISSAUGA, ONTARIO, L5N 2K7 Project No. D35.6
SUBCONTRACTOR	KENNEDY ELECTRIC LIMITED 201 WILKINSON ROAD BRAMPTON, ONTARIO, L6T 4M2
CLIENT	DEPARTMENT OF SUPPLY AND SERVICES - CANADA CONTRACT NO. 14SQ.23440-7-9006 ENERGY, MINES & RESOURCES CANMET, ERL DIVISION SYNTHETIC FUELS RESEARCH LABORATORY BELLS CORNERS c/o 555 BOOTH STREET OTTAWA, ONTARIO, K1A OG1

ELECTRICAL INSTALLATION SPECIFICATION
FOR
CO-PROCESSING PILOT PLANT
ELECTRONIC INSTRUMENTATION SYSTEM
DSS 14SQ.23440-7-9006

JANUARY, 1987

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16.1.1 GENERAL

The General Conditions of DSS Contract Serial No. 23440-7-9006/01-SQ and the Appendices thereto shall be deemed to apply and be a part of this Division as fully as if recited in full herein.

16.1.2 PROTECTION

In addition to the protection required to be provided under the General Conditions, securely cover, plug or cap conduits, raceways or other openings.

16.1.3 WORKMANSHIP

Only first-class workmanship will be acceptable. Exposed cable and conduit shall be lined up parallel or at right angles to building lines. Equipment shall be accurately set, plumbed and levelled. Hanger rods shall be installed at true vertical and of proper lengths. Poor workmanship will be rejected.

16.1.4 SYSTEM(S) START-UP INSTRUCTIONS, ETC.

Details on the commissioning of equipment, test runs, and system performance trials as well as requirements for instruction manuals and operating instructions are to be provided in accordance with the Contract.

16.1.5 MATERIALS AND EQUIPMENT

All materials and equipment used are to be new and are to have C.S.A. and/or Electrical Inspection Authority approval. Items specified by name imply such product to be used unless a substitute is approved by EMR.

Materials not specified by name shall be the best available.

16.1.6 CODES, REGULATIONS AND PRACTICES

Obey the codes and regulations of all governing authorities having jurisdiction over the Work.

Where the supply of an item, the wiring or installation method, etc., are specified only generally, without extensive detail, this implies the Work shall conform with the requirements of the governing authorities.

Conform to the best practices applicable to this type of Work. Install all equipment and systems in accordance with the general requirements of these Specifications.

16.1.7 PERMITS, INSPECTIONS, FEES, ETC.

Arrange for inspections of Drawings, equipment, materials and installation of Work and pay for permits, inpsection fees, certificates, etc., connected therewith. Deliver two copies of the final Inspection Certificate to EMR.

16.1.8 GROUNDING

All electrical systems, equipment, enclosures, and metallic raceways shall be properly grounded in accordance with the code and regulations of the governing authorities.

16.1.9 TESTS

Perform any and all tests as specified hereinafter or as required by EMR, supplying therefore the necessary equipment and labour.

Meggar test the wiring to ensure that insulation resistance is in accordance with the Code. Defective wiring shall be replaced.

16.1.10 AREA CLASSIFICATION

All wiring shall conform to the Electrical Safety Code requirements as listed.

Slurry Preparation Area 1 & 13 - Class 2, Group F, Division 2

Main Process Area 1 thru 12 - Class 1, Group B, Division 2

Operators aisle, Slurry Room and Computer Room are not classified areas

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16.2.5	WIRING CONNECTORS	2
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16.2.1 WORK INCLUDED

The work covered by this section includes, but is not necessarily confined to the supply and installation of:

a) Wiring to all process instrumentation, e.g., temperature controllers, solenoid valves, limit switches, level controllers, flow switches, thermocouples, etc.

16.2.2 WIRING METHOD

Unless otherwise specified, all wiring shall be surface mounted.

Exposed conduits are to be installed perpendicular and parallel to the building lines and pipe bridges. Where conduits are installed side by side, they shall be installed parallel and any bends made in the conduits are to be concentric. Conduit fittings may be used in place of concentric bends in a bank of conduit.

Limit any single run of conduit to a maximum of three 90 degree bends or equivalent. Install pull boxes required to accomplish this whether shown on drawings or not.

During construction, all conduits shall be kept clean by sealing the open ends with metal or paper pennies and bushings. All conduits are to be swabbed clean and dry before wiring is pulled in.

In the designated Class I, hazardous areas, provide conduits seals.

16.2.3 RACEWAYS, CABLES AND FITTINGS

Unless otherwise shown, all wiring shall be installed in rigid galvanized steel conduit.

All conduit fittings such as couplings, connectors, flexible conduit connectors, chase nipples, etc., shall be nylon insulated throat type Thomas & Betts manufacture or equal.

Running threads are not to be used in rigid conduit runs or connection to equipment. Only approved fittings for rigid conduit are to be used for this purpose.

Use T & B bullet hubs with O-rings on all connections to sheet metal enclosures in classified areas.

Connections to motors and other equipment, such as solenoid valves and

limit switches, are to be made using a short length of flexible conduit from a junction box terminating the rigid conduit located near the motor. Flexible conduit shall only be as long as necessary to provide the flexibility required and ground bonding shall be provided to satisfy the Inspection Department.

16.2.4 WIRES

Unless otherwise specified, all wiring conductors are to be copper type, RW90-X-link polyethylene insulated or THHN #14 AWG minimum.

Thermocouple and signal wire shall be multi conductor when run from panel to panel or junction box to panel. Individual pairs will provide 100% shield coverage; overall shield shall provide 100% shield coverage cable will have an overall P.V.C. jacket.

Individual pairs or triads with 100% shield coverage and a P.V.C. jacket shall be used to terminate all field devices to panels or junction boxes.

Thermocouple wire: 20 gauge, type J, iron/constantan, 100% shield coverage, P.V.C. jacket.

Signal wire: 20 gauge pairs or triads as required 100% shield coverage, P.V.C. jacket.

Controls 120VAC - #14 AWG THHN or RW90 X-link
line - red
neutral - white
ground - green

Power 120/208 VAC - #14 AWG THHN or RW90 X-link
line - black
neutral - white
ground - green

Control wiring and wiring for other systems shall also be colour coded throughout or identified by wire markers at both ends and at all junction and terminal boxes.

16.2.5 WIRING CONNECTORS

Joints in branch wiring conductors up to No. 8 gauge are to be made using Ideal wing nut type connectors with nylon shell.

16.2.6 DRAWING LIST

Refer to attached Drawing Schedule, 8 sheets, appended to this Section.

16.2.7 CONDUIT LIST

Refer to attached Conduit List, 9 sheets, appended to this Section.

DRAWINGS FROM CUSTOM CONTROL PANELS LIMITED

Drawing No.	Sheet	Rev.	Title
7748-1	1-3	1	Instrument Panel A1 Steel Fabrication Details
7748-1	2-3	-	--------- " ----------
7748-1	3-3	1	--------- " ----------
7748-2	1-1	1	Valve Switch Panel A2 Steel Fabrication Details
7748-3	1-2	-	Temperature Control Panel 'C' Steel Fabrication Details
7748-3	2-2	-	--------- " ----------
7748-4	1-1	-	SCR Panels D1 & D2 Steel Fabrication Details
7748-5	1-1	-	Coal Slurry Panel 'S' Steel Fabrication Details
7748-6	1-1	-	Coal Slurry Junction Box 1SL & 1S$ General Arrangement

DRAWINGS FROM CUSCO IND. INC.

Drawing No.	Sheet	Rev.	Title
M46-887-MI	1-6	1	Valve Switch Panel A2 Graphic Mosaic Graphic Layout
"	2-6	2	---------- " ----------
"	3-6	1	---------- " ----------
"	4-6	1	---------- " ----------
"	5-6	1	---------- " ----------
"	6-6	1	---------- " ----------
M46-887-M2	1-1	2	Instrument Panel A2 Graphic Mosaic Graphic Layout
M46-887-F1	1-1	-	Instrument Panel A1 Valve Switch Panel A2 Frame & Cut-out Dimension

DRAWING SCHEDULE

CLIENT
NAME: ENERGY MINES & RESOURCES
PROJECT: COPROCESSING PILOT PLANT
LOCATION: BELLS CORNERS
PROJECT#: 504102-01

KENNEDY ELECTRIC LIMITED
3065 UNIVERSAL DRIVE
MISSISSAUGA ONTARIO
416-624-0406

NOV 11/87 DRWG.# 8990-000-A
REV.# 0 JAN 28/88
SHEET # 1 OF 8
* REVISED THIS ISSUE

DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-000-A	1 TO 8	1	DRAWING SCHEDULE	
8990-000-B	1 TO 8	1	CONDUIT SCHEDULE	
8990-001	1	1	BUILDING LAYOUT 1ST FLOOR PLAN VIEW	
	2	1	BUILDING LAYOUT 2ND FLOOR PLAN VIEW	
8990-002	1	1	CONDUIT BLOCK LAYOUT	
8990-021	1	1	SLURRY PREPARATION AREA INSTRUMENT SITE LOCATION DETAIL MIXING TANKS, HEAT TRACING & THERMOCOUPLES	
	2	1	SLURRY PREPARATION AREA INSTRUMENT SITE LOCATION DETAIL FEED BIN & HOPPER	
8990-025	1	1	MAIN PROCESS AREA INSTRUMENT SITE LOCATION DETAIL ELEVATION VIEW	
8990-026	1	0	MAIN PROCESS AREA INSTRUMENT SITE LOCATION DETAIL FIRST FLOOR PLAN VIEW	
8990-027	1	0	MAIN PROCESS AREA INSTRUMENT SITE LOCATION DETAIL SECOND FLOOR PLAN VIEW	
8990-028	1	0	MAIN PROCESS AREA INSTRUMENT SITE LOCATION DETAIL THIRD FLOOR PLAN VIEW	
8990-029	1	0	MAIN PROCESS AREA REACTORS TYPICAL CONDUIT CONNECTIONS	
8990-030	1	0	MAIN PROCESS AREA REACTOR #1 DETAIL	THERMOCOUPLE, HEAT TRACING & VALVE LOCATION
8990-031	1	0	MAIN PROCESS AREA REACTOR #2 DETAIL	THERMOCOUPLE, HEAT TRACING & VALVE LOCATION
8990-032	1	1	MAIN PROCESS AREA HOT RECEIVER DETAIL	THERMOCOUPLE, HEAT TRACING & VALVE LOCATION

DRAWING SCHEDULE

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DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-100	1	0	CONNECTION DETAIL FLOW SWITCH	FS INSTRUMENTS
8990-101	1	0	CONNECTION DETAIL MOTOR OPERATED VALVE WITH POSITION INDICATION	HV, ZSL INSTRUMENTS
8990-102	1	0	CONNECTION DETAIL SOLENOID VALVE	HY, HV INSTRUMENTS
8990-103	1	0	CONNECTION DETAIL HEATER CABLES	TY INSTRUMENTS
8990-104	1	0	CONNECTION DETAIL MAGNETIC PICK UP	ST INSTRUMENTS
8990-105	1	0	CONNECTION DETAIL LEVEL SWITCH	LAH, LAL INSTRUMENTS

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DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-121	1	0	CONNECTION DETAIL CURRENT TO PRESSURE TRANSDUCER	SY, WY, LY, TY, FY, INSTRUMENT
8990-122	1	0	CONNECTION DETAIL PRESSURE TRANSDUCER	PT INSTRUMENTS
8990-123	1	0	CONNECTION DETAIL LEVEL & FLOW TRANSMITTER	FT, LT INSTRUMENTS
8990-125	1	0	CONNECTION DETAIL RTD TEMPERATURE TRANSMITTER	TT INSTRUMENTS
8990-126	1	0	CONNECTION DETAIL SPEED TRANSMITTER (MAGNETIC PICK-UP)	ST INSTRUMENTS
8990-128	1	0	CONNECTION DETAIL THERMOCOUPLE	TE INSTRUMENTS

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DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-150	1	0	MOUNTING DETAIL JUNCTION BOX	
8990-151	1	0	MOUNTING DETAIL CONDUIT PASSAGE THROUGH STEEL WALL	

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DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-200	1	1	THERMOCOUPLE JUNCTION BOX #1A1 TERMINATIONS MAIN PROCESS AREA 3,4,5,6&7	TERMINAL 3A
	2	1	THERMOCOUPLE JUNCTION BOX #1A1 TERMINATIONS MAIN PROCESS AREA 3,4,5,6&7	TERMINAL 3B
	3	1	THERMOCOUPLE JUNCTION BOX #1A1 TERMINATIONS MAIN PROCESS AREA 3,4,5,6&7	TERMINAL 3C
	4	1	THERMOCOUPLE JUNCTION BOX #1A1 TERMINATIONS MAIN PROCESS AREA 3,4,5,6&7	TERMINAL 3D
	5	1	THERMOCOUPLE JUNCTION BOX #1A1 TERMINATIONS MAIN PROCESS AREA 3,4,5,6&7	TERMINAL 3E
	6	1	THERMOCOUPLE JUNCTION BOX #1A1 TERMINATIONS MAIN PROCESS AREA 3,4,5,6&7	TERMINAL 4A
8990-201	1	1	PANEL A1 SIGNAL DEVICE TERMINATIONS MAIN PROCESS AREA 4,5,6,7,8,9&11	
8990-202	1	1	PANEL A1 CONTROL DEVICE TERMINATIONS MAIN PROCESS AREA 3,4,5,9&12	
8990-203	1	1	PANEL A1 TO PANEL C THERMOCOUPLE INTERCONNECTIONS	
8990-204	1	1	PANEL A1 SIGNAL INTERCONNECTIONS TO PANEL B1 PANEL B1 SIGNAL DEVICE TERMINATIONS MAIN PROCESS AREA 8	PRESSURE TRANSMITTERS

DRAWING SCHEDULE

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RAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
990-300	1	0	PANEL A2 CONTROL DEVICE TERMINATIONS MAIN PROCESS AREA 2,4,5,8&10	
990-400	1	1	THERMOCOUPLE JUNCTION BOX #1C TERMINATIONS MAIN PROCESS AREA 3,4,5,6,7&8	TERMINAL 3F
	2	1	THERMOCOUPLE JUNCTION BOX #1C TERMINATIONS MAIN PROCESS AREA 3,4,5,6,7&8	TERMINAL 3G
	3	1	THERMOCOUPLE JUNCTION BOX #1C TERMINATIONS MAIN PROCESS AREA 3,4,5,6,7&8	TERMINAL 3H
	4	1	THERMOCOUPLE JUNCTION BOX #1C TERMINATIONS MAIN PROCESS AREA 3,4,5,6,7&8	TERMINAL 4A
	5	1	THERMOCOUPLE JUNCTION BOX #1C TERMINATIONS MAIN PROCESS AREA 3,4,5,6,7&8	TERMINAL 4B
90-401	1	0	PANEL C HEAT TRACING TERMINATIONS SLURRY PREPARATION AREA 1	
90-402	1	0	PANEL C HEAT TRACING TERMINATIONS MAIN PROCESS AREA 2,3,4,5,6,7&8	
0-403	1	1	PANEL C SIGNAL DEVICE TERMINATIONS MAIN PROCESS AREA 5	
0-404	1	1	PANEL C SIGNAL WIRING CONNECTIONS TO PANEL D1 & D2 PANEL D1 & D2 HEAT TRACING TERMINATIONS MAIN PROCESS AREA 2,3&4	

DRAWING SCHEDULE

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DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-700	1	1	MOTOR OPERATED VALVE JUNCTION BOX #1SL TERMINATIONS	PANEL S
8990-701	1	1	MOTOR OPERATED VALVE JUNCTION BOX #1SR TERMINATIONS	PANEL S
8990-702	1	1	THERMOCOUPLE JUNCTION BOX #1A TERMINATIONS	PANEL A1 & PANEL S
8990-703	1	1	THERMOCOUPLE JUNCTION BOX #2A TERMINATIONS	PANEL A1 & PANEL C
8990-704	1	1	THERMOCOUPLE JUNCTION BOX #1B TERMINATIONS	PANEL S
8990-705	1	1	PANEL A1 & PANEL S INTERCONNECTIONS & SIGNAL WIRING TO AREA 1&13	
8990-706	1	1	PANEL S HEAT TRACING & CONTROL DEVICE TERMINATIONS TO SLURRY PREPERATION AREA 1&13	

DRAWING SCHEDULE

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DRAWING NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE	COMMENTS
8990-800	1	1	RPU #1 TERMINAL #FTB11 SIGNAL INTERCONNECTIONS TO PANEL A1	
	2	1	RPU #1 TERMINAL #J1 & J2 THERMOCOUPLE INTERCONNECTIONS TO PANELS A1 & C	
	3	1	RPU #1 TERMINAL #J3 & J4 THERMOCOUPLE INTERCONNECTIONS TO PANEL C	
	4	1	RPU #1 TERMINAL #J5 & J6 THERMOCOUPLE INTERCONNECTIONS TO PANELS A1 & C	
	5	1	RPU #1 TERMINAL #J7 & J8 THERMOCOUPLE INTERCONNECTIONS TO PANELS A1 & C	
8990-801	1	1	RPU #2 TERMINAL #FTB1,2&3 SIGNAL INTERCONNECTIONS TO PANELS A1 & B1	
	2	1	RPU #2 TERMINAL #FTB4,5&6 SIGNAL INTERCONNECTIONS TO PANELS A1 & C	
	3	1	RPU #2 TERMINAL #FTB7,8&9 SIGNAL INTERCONNECTIONS TO PANELS A1 & C	
	4	1	RPU #2 TERMINAL #FTB10,11&12 SIGNAL INTERCONNECTIONS TO PANELS A1 & A2	
	5	1	RPU #2 TERMINAL #J1,2,3&4 THERMOCOUPLE INTERCONNECTIONS TO PANELS A1 & C	

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The New Coprocessing Pilot Plant at CANMET's Energy Research Laboratories

J.D. Chase and D.D.S. Liu

January 1988

For presentation at the Third Chemical Congress of North America, Toronto, June 5-11, 1988.

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Division Report ERL 87-89(OPJ)

THE NEW COPROCESSING PILOT PLANT AT CANMET'S ENERGY RESEARCH LABORATORIES

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I. INTRODUCTION

Canada's large deposits of heavy oil and coal and their proximity warrants the development of coprocessing technology. Coprocessing involves treating a slurry of coal in heavy oil, bitumen or resid with high pressure hydrogen with or without other reducing gas between 400°C and 500°C. Under these conditions coal liquefies and the coal-derived liquids together with the heavy oil hydrocrack to lighter materials.

The advantages of coprocessing over coal liquefaction have been known for some time and and bench-scale research in coprocessing has been underway at CANMET since about 1980. (1,2,3). The bench-scale experiments have indicated a considerable economic potential for the simultaneous processing of coal and bitumen. To develop this process to a stage where it can be evaluated with confidence for further scale-up to demonstration size,the construction of a half-tonne per day pilot plant was initiated.

Whereas the bench-scale facilities are being used to investigate the effect of the process variables on the product yields and quality in short experimental runs, the large pilot plant will be used to solve problems that normally result from long experimental runs lasting up to 60 days. Further, the pilot plant will be able to generate more accurately yield data that is not normally possible with smaller bench scale units, and will enable the production of the much larger quantities of products needed for the detailed assessments required for commercialization.

This paper describes the coprocessing pilot plant which is now being commissioned at CANMET's Energy Research Laboratories.

II. PROCESS DESCRIPTION

(a) Design Basis

- Nominal space velocity of 1.0 reactor volumes/h (1.0 LHSV)
- Feed slurry concentrations of coal from 5 to 50 wt %
- Hydrogen recycle rate of 200 L/h at 15°C (13.9 MPa)
- Pressure capability to 21 MPa (≈3000 psi)
- Reactor temperature to 500°C.

(b) Description of Flow Diagram

The coal from producers will be ground and dried in a new coal preparation unit. This facility handles coal up to 0.63 cm (1/4 in.) in size and up to 60% moisture to produce up to 227 kg/h of dry coal (maximum 10% moisture) at a maximum particle size of 74 μm (-200 mesh). The dried coal is put in 45 gallon drums with plastic liners and sealed to exclude moisture. The ground coal is then mixed with heated heavy oil in tanks. After mixing with the recycled gas stream containing the the desired concentration of hydrogen, the hot feed slurry is pumped through a preheating section into the reactor which will be maintained at the desired reaction temperature by electrical heaters (Fig.1). The temperature profile in the reactor is measured and controlled by external heaters. Provision has been made for introduction of other process monitors such as pressure transducers and densitometers.

The effluent from the reactor is fed to a high temperature high pressure separator from which a heavy oil product (containing any undissolved coal) is withdrawn. The overhead are then fed to a low temperature-high pressure separator from which a light oil is collected. The gas is then fed to the scrubbing section which removes gaseous hydrocarbons, as well as gaseous nitrogen and sulphur compounds. This scrubbed H_2 stream is then recycled after addition of fresh make-up hydrogen to the recycle gas and then mixed with slurry entering the preheater. Off-gas streams from the product let-down systems will be measured and analyzed.

The feed and the two liquid product streams are weighed continuously, then samples of the product are distilled and analyzed. Considering the flowrates used and the accuracy in measurement, a good mass balance can be expected.

III. PILOT PLANT - ASSEMBLY OF SUB-SYSTEMS

(a) Slurry Preparation Section

The slurry preparation system consists of two tanks, two slurry recirculation pumps and two recirculation loops 4 and 50 m long respectively. The internal pipe size in these loops is 3.81 cm. Since the slurry viscosity is very dependent on temperature, the piping and tanks are equipped with heaters. The length of the larger loop was determined according to the location of the slurry preparation area, i.e., some distance from the main processing area. The high pressure reciprocating feed pump in the process area is fed by part of the recirculating slurry at one end of the large loop. The shorter loop is used for circulating slurry in the other tank when it is not in use, or when the slurry is being prepared from coal and heavy oil. Figure 2 shows a photograph of the slurry area.

Sizing of lines and the power required for recirculating the slurry were estimated for the linear velocity required to prevent settling of coal particles based on Spell's equation (4). The system was designed so that either recirculation pump could be used with either tank in the event of failure during operation. This flexibility along with other characteristics of the long loop make it ideal for the study of mixing phenomena, or in the absence of other data, a means for determining slurry viscosity from known flow and pressure drops.

During slurry preparation, the coal and heavy oil contacting will be done by: (a) an agitator within the tank, (b) recycle flows through the 4 m loop or (c) the use of an eductor within the short loop.

In the coal liquefaction literature interesting rheological behaviour is described where the temperature - viscosity relationship indicates the presence of a gel at certain temperatures (5). Since similar rheological characteristics may be encountered with coal/heavy oil slurries the preheater section has numerous temperature and pressure sensors for monitoring the rheology and flow control (6).

(b) Reactors

The pilot plant has two tubular reactors. One has a 18-L capacity, is 7.62 cm in diameter and is 3.937 m long. The other has a 10-L capacity, is 5.08 cm in diameter and is 4.876 m long. Also there is a 10-L continuous stirred tank reactor (CSTR).

The reactors and separators were designed to accommodate instruments for studying fluid dynamics and for changing reactor geometry. Reactor configuration can be altered to study residence time distributions under various conditions.

The maximum L/D ratio for the tubular reactors is 96. The ratio can be reduced by using one of many holes in the wall as the outlet. The reactors can be connected in various ways for different experiments including multi-step processes. Combinations of CSTR and tubular reactors with various L/D ratios will enable the study of the effect of the degree of mixing on the coprocessing reaction for a wide range of Peclet numbers. Such data are often required to develop or verify scale-up models (7).

The hydrodynamic phenomena of slurry bubble columns at high temperatures and pressures are not well understood. Consequently our experience derived from the use of gamma-ray interrogation techniques during CANMET's development of hydrocracking processes will be applied to coprocessing (8). Figure 3 shows the gamma-ray scanner which will be modified slightly for this new system.

The many thermocouples and sampling systems in the three reactors have resulted in complex instrumentation. This complexity is illustrated in the piping and instrument diagram shown in Fig. 4. The sampling system involves metering control valves and this is seen in the photograph in Figure 5.

(c) Product Separation

It is necessary to separate the products in the reactor effluent. The design of the hot and cold separators was based on experience obtained from hydrocracking of vacuum tower bottoms or bitumen. Although no difficulty is anticipated in the discharge of undissolved coal solids, the efficient removal of solids from reactor effluent is likely to warrant further study. Extra vessels or solids separation equipment can easily be connected to the bottom of the high temperature separator.

The gases from the cold separator initially will be scrubbed by a water and oil scrubber. These scrubbers were designed for investigation of mass transfer. Effective gas clean-up will be required if coprocessing plants are built. Eventually absorbant liquids other than water and oil will be studied.

(d) Gamma-Ray Densitometer

Techniques have been successfully developed for the study of hydrodynamic phenomena in hydrocracking reactors using gamma-ray densitometry. The techniques measure the spatial and temporal void fractions, flow regimes, and bubble size distributions in the reactor (6). These techniques which were developed in our laboratories, contribute to the development, scale-up and successful operation of a large scale Canadian hydrocracking process. The application of gamma-ray densitometry in solid sedimentation is being developed. All of these techniques will be incorporated in the new coprocessing pilot plant. The dotted vertical line in Fig. 4 represents the track for the gamma-ray densitometer.

IV. COMPUTERIZED PROCESS MONITORING SYSTEM

The plan is to have the pilot plant controlled by dedicated controllers. All plant data are collected and stored by a computerized data acquisition and process monitoring system. Field sensors such as thermocouples and pressure gauges are wired to remote processing units (RPU) which perform analogue to digital conversion and translate the sensor output to engineering units. The signals from the RPU are then sent to a plant computer which can display data in various formats including mimics, historical trends and alarm indication. All points are scanned every 10 seconds on average. The plant computer sends all data every minute to the central computer that keeps all the information on a hard disk. Minute and hourly averages are stored for up to 60 days and written every hour to tape. The data stored by the central computer can be recalled for trends, plots and reports. The central system handles data from three separate pilot plants. As a precaution, 60 of the most important points are also recorded on multichannel strip chart recorders. Those points recorded by the computer are shown in Fig. 4 by a circle within a square.

V. REFERENCES

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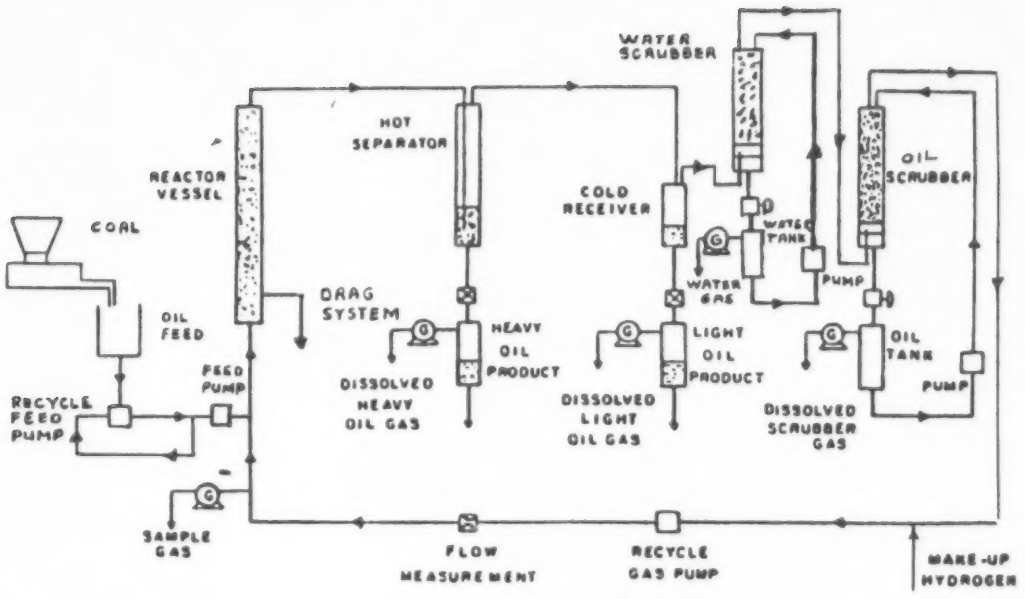

FIGURE 1. SCHEMATIC FLOW SHEET OF COPROCESSING PILOT PLANT

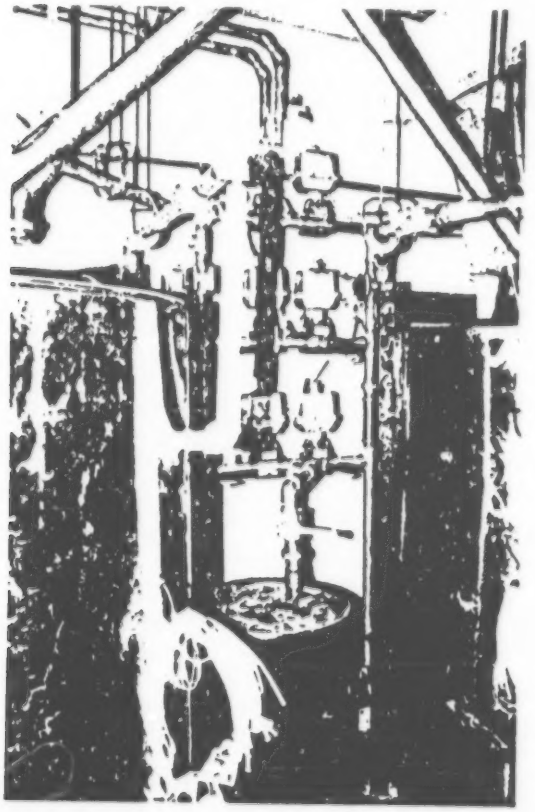

FIGURE 2. PHOTOGRAPH OF SLURRY PREPARATION AREA

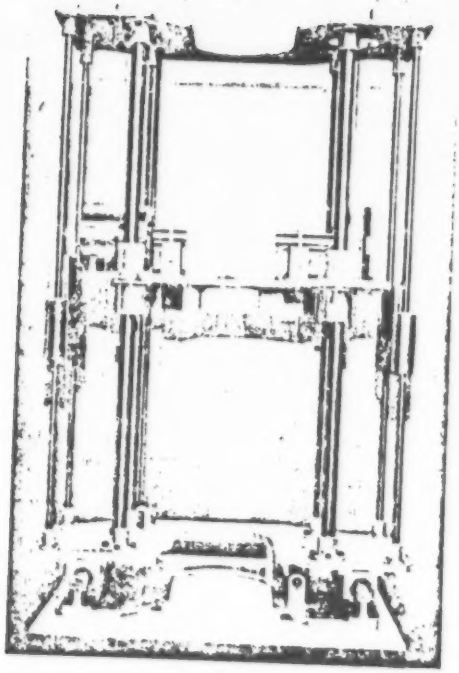

FIGURE 3. GAMMA-RAY SCANNER

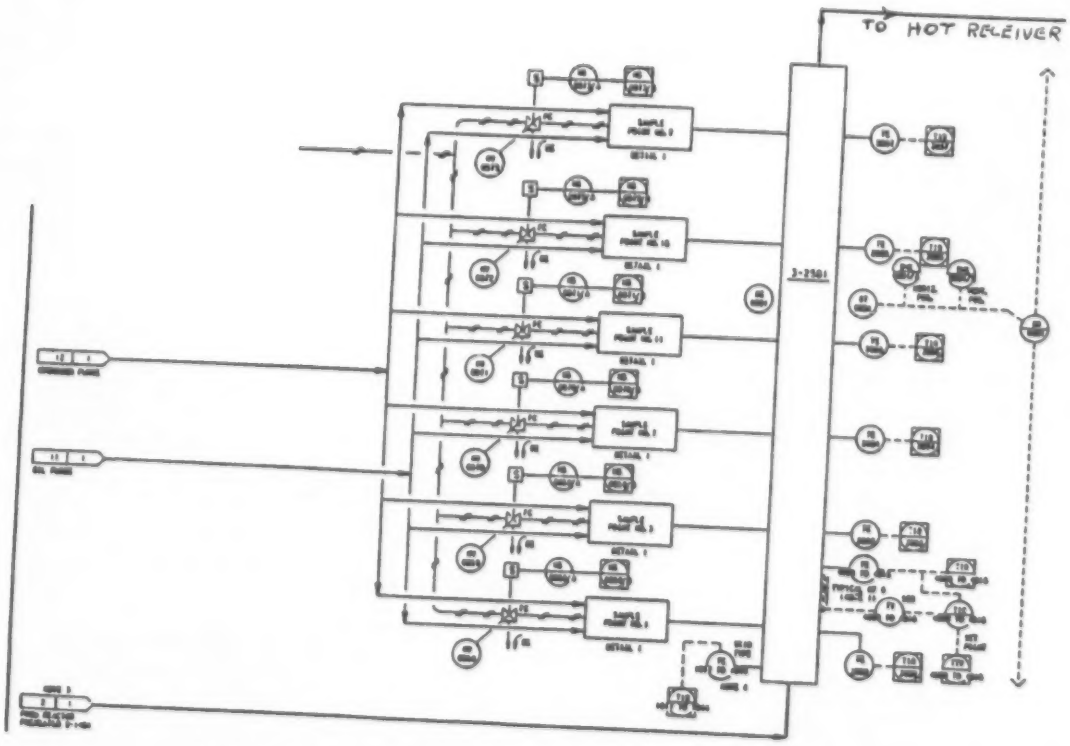

FIGURE 4. PARTIAL P&ID OF TUBULAR REACTOR

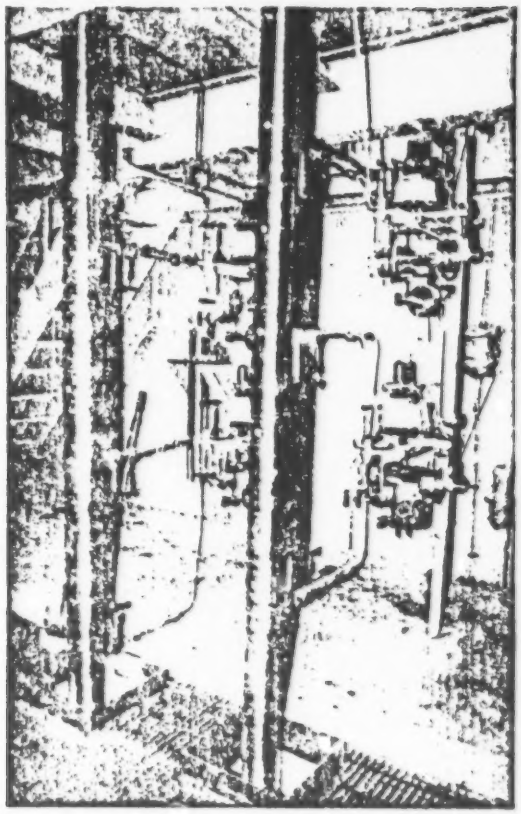

FIGURE 5. PHOTOGRAPH OF TUBULAR REACTOR